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TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME LXIII

# SOME NOTES ON BOREAL AMERICAN DORCINAE

## (COLEOPTERA: LUCANIDAE)

BY BERNARD BENESH

*North Chicago, Illinois*

(Plates I-III)

The following study, undertaken to clarify the validity of some of our Dorcinae, is submitted as an answer to a contribution by Dr. Skinner, entitled " Two rare species of Coleoptera ".[1]

Several years ago, Mr. H. P. Löding of Mobile, Alabama, returned to the writer a questionnaire on the distribution of North American Lucanidae, with a check list of all the species taken by him, accompanied with complete data; amongst these, was noted the troublesome *Dorcus brevis* (Say), marked " teste H. S. Barber ". Being acquainted with the insect only through the literature of past entomologists, each one with a different idea regarding this interesting and seldom met with species, and, desiring to examine his specimens, the writer applied for a loan of an example for study. It is needless to say that Mr. Löding graciously granted the request and sent the insect for study. It was a female with a total length (mandibles included) of 19.5 mm.

On receipt of the specimen, the writer was so impressed by the differences between *D. parallelus* (Say) and the specimen in question, that he immediately wrote to the well known student of Lucanidae, Mr. Paul Nagel, of Hanover, Germany, giving full particulars of the differences noted. In reply, Nagel wrote: " I have a fine male and female of *Dorcus brevis;* it is a fine species and quite distinct from his (Say's) *parallelus*. The differences that you noted are quite correct".

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[1] Ent. News, xxii, p. 354, (1911).

In comparing the specimen of *brevis* with *parallelus,* the specific characteristics were so apparent, that a short diagnosis was made and a copy sent to Mr. Löding, who replied: "On the receipt of your letter, manuscript and the specimen, I have to confess that on closer examination I find differences to make me believe that my other specimen is a male. I will have to send it to you for examination". On arrival, the example proved to be an exceptionally small male, 16.75 mm. long (mandibles included).

As this species was very poorly represented in collections, when this study was undertaken in 1930, obtaining additional material for study was a handicap for some time. Mr. Nagel very kindly loaned the only pair in his collection; the original material from which Albers had drawn his description; whilst the Academy of Natural Sciences of Philadelphia, sent a fine representation of their collection for study, including the entire collection of Dr. Geo. H. Horn, especially valuable for its illumination on the stand taken by him on the relationship of *D. brevis* and its suppression as a valid species. Mr. Angell, a life-long student of American Lucanidae, who through persistent efforts lasting nearly three decades had secured a small series of seven examples, was especially instrumental by furnishing data contributing to the systematic plotting of the distribution of the insect, incidentally furnishing the "missing link" in the chain, enabling the writer to successfully place the center of distribution and acquire a long series of the beetle for this extensive study. Before listing all the differences noted, a short résumé on this interesting insect will not be amiss.

Thomas Say described *brevis* from a male, under the generic name *Lucanus,* as follows: "short and wide; mandibles one toothed: elytra smooth, humerus mucronate. Body robust, reddish-brown: head wide, rather narrower than the thorax, minutely punctured, a little concave above the mandibles; mandibles short, with one oblique tooth on the middle, extending inwards; thorax wide with minute punctures, angles rounded, posterior ones not *obliquely truncate;*[2] elytra smooth, having numerous small punctures and obsolete, hardly impressed lines; humerus mucronate: anterior tibiae with five or six small denticulations, and a broad terminal one widely emarginate; intermediate tibia with a single spine on the middle. Length nearly nine-tenths of an inch. This species seems to be related to *parallelus* nobis, but is much wider in proportion to its length and there are no distinct striae on the elytra."

The species was lost for thirty-seven years, until J. H. B. Bland[3] again figured and briefly gave its history in 1862. Dr. J. L. Leconte in his edition of Say's Entomology,[4] remarks: " a species of Dorcus unknown to me ".

Major F. J. S. Parry[5] writes: " With respect to the insect noted as *Dorcus brevis* of Say, I have, after most careful examination and comparison with numerous specimens of *Dorcus parallelus,* Say, a not uncommon North American species, arrived at the conclusion, that the specimen in question must be considered as only an old worn state of *D. parallelus* in which the striae of elytra have become obsolete, the apex of the mandibles blunt, and the teeth of the tibiae considerably worn down, thus modifying its usual appearance; and Say's description appears to me to afford nothing opposed to this view ".[6]

Chas. Fuchs[7] says: " Regarding the variety of *brevis* Say, there is still considerable difference of opinion as to whether it really is entitled to rank as a species. It differs from *parallelus* in the smooth elytra, and the remarkable development of the head and thorax: the head being broader and nearly as long as the thorax, though the mandibles are not in proportion to this development. The insect is exceedingly rare, and while I am inclined to believe in its specific distinctness from *parallelus,* Dr. Horn strongly insists that it is only a variety, basing his opinion upon analogous variations observed in foreign species. In deference to his opinions based on a wider acquaintance with the family than we can boast of, *brevis* is here brought in as a variety. All the specimens of this variety have been found in New Jersey so far as we have been informed. This would seem to make it, if a variety at all an exceedingly local one, and curious and interesting for that reason. Mr. Charles Wilt of Philadelphia has a fine series of four beautiful specimens ".[8]

---

[2] The italics are mine.

[3] Proc. Ent. Soc., Phila., I, p. 263, (1862).

[4] Vol. 2, p. 303, (1859).

[5] Trans. Ent. Soc. of London, 1870, p. 73.

[6] Parry did not possess a *brevis,* and never saw one.

[7] Bull. Brooklyn Ent. Soc., v, p. 52, (1882).

Next reference to this species and which includes also the female, is by Senator G. F. Albers, one of the foremost authorities on Lucanidae. He writes: [9]

> Abgesehen von Färbung, welche bei dem Männchen pechbraun, beim Weibchen gar roth-braun ist, ist hervorzuheben, das der Käfer viel flacher gebaut ist. Die Flügeldecken sind nicht parallelseitig, sondern eiförmig, an der Basis nicht rechtwinklig zur Axe des Kiefers abgestuzt, sondern gemeinschaftlich tief ausgebuchtet, wodurch es veranlasst wird, dass die Schulterzähne ausserordentlich stark und hakenförmig vorspringen. . . . Beim Weibchen sind die Seitenränder des Brustschildes deutlich gekerbt und die Furchung der Flügeldecken ebenso kräftig und noch gleichmässiger als bei dem *parallelus*. Zur diagnosieren würde der Käfer etwa so sein:
>
> Piceus vel rufo-piceus, subdepressus, punctatissimus, mas subopacus, femina nitidior; mandibulis maris supra dente elevato, porrecto, subtus in margine interiore denticulis duobus instructis; elytris utriusque sexus basi conjunctim emarginatis, dente humeralis hamatim producto instructis, maris vix striato-punctatis, feminae in dorso sulcatis. Long. ♂ 23 mill., ♀ 18 mill. Patria: America borealis.
>
> Genauer vermag ich das Vaterland nicht anzugeben. Ich erhielt den Käfer vor längeren Jahren aus einer Auswahlsendung einer kleinen, sehr frischen und ausgezeichnet gehaltenen Sammlung nordamerikanischer Käfer, unter sich auch der seltene *Polymaechus brevipes* Leconte befand. Da dieser sich in New Jersey findet, so mag dieses auch wohl der Fundort meiner beiden Stücken von *D. brevis* Say sein.[10]

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[8] Mr. Chas. Liebeck of Philadelphia, stated in correspondence, that he had examined the collection, before it passed from Wilt's hands and advised the author that these insects were not among the material viewed; apparently, the four beautiful specimens are lost to science.

[9] Deutsche Entomologische Zeitschrift, 1883, p. 221.

[10] Löding writes: " this is rather far-fetched, as *Polymaechus brevipes* also occurs here in Alabama; the specimens could as well be from this locality."

In perusing the article by Dr. Horn,[11] the writer is puzzled as to why Dr. Horn insisted that *brevis* was a variant of *parallelus*. The distinction is such that it cannot escape the notice even of an average coleopterist; but his set opinion is very evident, as he writes: "Periodically the question is discussed, what is *Dorcus brevis*, and is it distinct from *parallelus*. It need hardly be said that this question arises principally among those young in experience and with a small series, etc." Wickham[12] states: "this variety is rare and I have never seen it." The last reference to this beetle is by Dr. Skinner,[13] who gave its full history, with present locations of the several known existing specimens, suggesting that if there are additional specimens known, they should be placed on record.

The material examined by the writer consists of 185 males and 24 females, and is located in the following collections: Agricultural and Mechanical College, Stillwater, Oklahoma, 5; American Museum of Natural History, New York, 2; John W. Angell, New York, 30; Bernard Benesh, North Chicago, 74; British Museum (Natural History), London, 9; Clemson College, South Carolina 2; Dr. R. Didier, Paris, 4; E. Dluhy, Chicago, 13; H. C. Fall, Tyngsboro, Massachusetts, 2; Field Museum of Natural History, Chicago, 4; F. C. Hadden, Honolulu, 13; Hincks-Dibb, Leeds, England, 2; Illinois Natural History Survey, Urbana, 2; E. R. Leach, Piedmont, California, 10; Leiden Museum, Leiden, Holland, 4;[14] H. P. Löding, Mobile, Alabama, 2; Dr. Y. Miwa, Taihoku, Formosa, 2; Herr P. Nagel, Hannover, Germany, 7; Monsieur René Oberthür, Rennes, France, 8; Dr. V. M. Tanner, Provo, Utah, 2; U. S. National Museum, Washington, D. C., 7. Of the collection of the Academy of Natural Sciences, Philadelphia, 5 specimens were seen, but as their entire collection was not examined, it is probable that many more are there yet to be discovered. The material exhibited so many variations in the sculpture of the head, prothorax and elytra, as well as in its size, that it was deemed expedient to select several typical forms and describe them individually, placing those thus described and figured for the first time, as types in the writer's collection, and designating a neotype to replace Say's type, which unfortunately cannot, with certainty, be located.

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[11] Ent. News, III. p. 73, pl. 3, (1892).

[12] Can. Ent., XXXI, p. 23, (1899).

[13] Ent. News, XXII, 354, (1911).

[14] Loaned to that institution for comparison purposes and not returned to the writer.

The insect is at variance with our well-known species of *Dorcus;* apparently, it is a connecting link or bridge, between the genus *Dorcus* and the Indo-malayan *Ægus,* its nearest relative. To the latter, it is allied by the depressed body, mandibular variations (in the males), sculpture of the head, prothorax and elytra (both sexes), besides other characteristics. The large females with their cephalic conical tubercles indicate its near relationship to *Dorcus,* whereas the smaller females with this character wanting, associate it with *Ægus.* It differs from congeners in its broad mentum, approximating in this respect the Oriental genus *Serrognathus* Motschulsky (=*Eurytrachellelus* Didier).

**Dorcus brevis** (Say) (Pls. I, II, III.)

1825. *Lucanus brevis* Say, Jour. Acad. Nat. Sci. Phila., v, p. 202.

Body obovate, depressed. Head quadrangular, broader than long, flattened frontally, sides nearly parallel, broadest behind the eyes. Eyes rather small, very nearly divided by the canthus, which protrudes well beyond the eyes (especially in the female). Mentum broadly transversal, anterior angles rounded, posterior angles square, shallowly, closely pitted. Gula wide in front, attenuated posteriorly. Prothorax nearly quadrangular, slightly broader than long, broadest at the middle, nearly flat on disc, laterally nearly parallel, anterior angles acutely, posterior angles broadly rounded; prosternal process elongate, slightly canaliculate posteriorly, terminating in a rounded tubercle. Elytra longer than the head and prothorax combined, broadest one-third from its base and thence gently attenuated to apex; humeral angles well formed, projecting obliquely to the front, terminating in an acute, hook-like point. Legs short; femora slightly swollen near the center; anterior tibiæ palmate, armed with five, (except in the smallest female form just recently discovered) well separated, conical spines; intermediate and posterior tibiæ with a single spine near its middle. Tarsi short, joints symmetrical, sparsely clothed on the venter with golden, silk-like hairs; claws simple. Tibiæ (♀) with rows of short, golden hairs.

Male form A

Length, with mandibles, 27.5 mm.

Head transverse, rounded in front, posteriorly as wide as the prothorax, disc feebly depressed, minutely, closely granulate punctate, subopaque, occiput shining. Mandibles shorter than the head, curved inward from the middle, armed dorsally near the middle with a single, obtuse, obliquely inwardly pointing tooth; on the inferior margin, below the upper tooth, a very ill-defined tubercle. Prothorax broader than long, widest in front and tapering posteriorly, smooth, opaque. Scutellum broad, pointed at apex, with a few basal punctures, shining. Elytra smooth, feebly shining the full length of the suture, balance opaque. Color coalblack to pitchy-black. Ventral areas finely granulate; abdominal segments shallowly punctured.

*Type.*—♂; Deer Lodge, Tennessee, June 17, 1932, collected by the author and in his collection; accession number 2145.

*Paratopotype.*—1 ♂, July 22, 1932, [Angell collection, ex-coll. B. Benesh].

*Paratypes.*—2 ♂; presumed to be from near Weymouth, New Jersey, as recorded by Bland* [Acad. Nat. Sci. Phila., ex-coll. Bland]. 1 ♂; Lakehurst, New Jersey, Aug. 18, 1930, (Chas. O. Ballou, Jr.; found dead), [Angell collection].

This is the rarest form known, being represented in the collections examined by just five examples; the example recorded from Lakehurst, New Jersey, is slightly smaller (½ mm.) than the other typical material and shows a transition in coloration to the next form. Form A differs from the succeeding form by the shorter mandibles, obtusely rounded dorsal tooth, smooth elytra and by its color.

Male form B

Length with mandibles, 26 mm.

The original description by Say is applicable to this form, with the exception that the measurements given (nine-tenths inch)[15] do not agree; mandibles elongate, nearly straight, curved inwards from the apical third, terminating in an acute point; on the upper side with an median acutely pointed tooth, which points obliquely to the front; on the inferior margin with an elongate, subconical tubercle (just below the upper tooth). Head, prothorax and the elytra finely and closely punctured; elytra with two obsolete striæ, extending one-third the elytral length, with the suture feebly shining. Color ferrugineous, subopaque. Beneath, as in form A.

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* Proc. Ent. Soc., Phila., 1862, I, p. 263, (1862).

[15] It is probable that Say gave measurement over the body to the clypeus, which would nearly agree with those of Albers and mine.

*Type.*—Described from the data supplied by the late Chas. W. Johnson, Museum of the Boston Society of Natural History, from an example which is assumed to be the Say's type; and from the Albers material, secured through the courtesy of Herr Nagel, and which is here designated a neo-type. Exact localities whence these examples originated are unknown and the data as published by Albers is unreliable.

*Paratypes.*—1 ♂ ; Deer Lodge, Tennessee, May 23, 1933, (Wm. Pelc. collector), [Benesh collection; accession number 2844]. 1 ♂, North Carolina, [J. W. Angell collection, ex-coll. Geo. Angell]. This is the second largest form known, and seems to be as rare as the first described; no other examples are known, except those here recorded.

Male form C

An intermediate link between the preceding forms and the following.

Length, including mandibles, 23 mm.

Head transverse, broader than long, rounded anteriorly, distinctly narrower than the prothorax, finely punctured, opaque, producing a shagreened effect. Several coarse, pit-like punctures near the base of the mandibles and around the eyes. Mandibles distinctly arcuate, with the apex and the dorsal tooth acutely pointed, the latter diminished in size. Prothorax transverse, nearly as long as wide, with the lateral sides distantly and coarsely punctured.

In this insect, which is very opaque and of dull appearance, the elytral striae are more pronounced than in form B, and reach within two-thirds the elytral length; the suture is feebly shining to three-fourths the length; lateral margins rugulose.

*Type.*— ♂ ; Deer Lodge, Tennessee, June 9, 1932, collected by the writer and in his collection; accession number 2146.

*Paratopotype.*—1 ♂ ; Deer Lodge, Tennessee, June 7, 1932, [Angell collection, ex-coll. B. Benesh].

Male form D

Length, mandibles included, 19 mm.

Head nearly round, narrower than the prothorax, rather coarsely punctured with shallow, pit-like punctures, more pronounced around the eyes; occiput with several fine punctures, shining. Mandibles with the dorsal tooth dwarfed, the inferior marginal tubercle more enlarged, and medially excavate, making it appear as a bifid tooth. Elytra striate, with irregularly confluent punctures. Prothorax broader than long, disc finely punctured, lateral sides and base, well covered with large, distant punctures. Color variable, from coal-black to ferrugineous; with the exception of the opaque lateral margins of the elytra, the insect is distinctly shining. This is the forerunner of the striate forms, showing the characteristics of the opposite sex.

*Type.*—♂; Deer Lodge, Tennessee, June 8, 1932, collected by the author, and in his collection, accession number 2149.

*Paratopotype.*—1 ♂; Deer Lodge, Tennessee, October 9, 1932, [Angell collection, ex-coll. B. Benesh]. This form appears to be the most abundant.

Male form E

Length, with mandibles, 16.75 mm.

Similar to the preceding, excepting that the head is more rounded posteriorly and coarsely rugose. Above the eyes, towards the front, there is a well-defined, nearly impunctate, shining tubercle. Prothorax nearly quadrate, broadest near the anterior half, covered with fairly large, distant punctures. Elytra, although not as shining as in the smallest form, bear sixteen irregular striae, with large, confluent punctures; lateral margins very coarsely granulate. Basal third of the head, prothorax and the elytral suture strongly shining.

*Type.*—♂; Deer Lodge, Tennessee, July 17, 1932, B. Benesh, collector, and in his collection, accession number 2156.

*Paratopotype.*—1 ♂; Deer Lodge, Tennessee, June 17, 1932, [Angell collection, ex-coll. B. Benesh].

In this form some individuals have the elytral interspaces highly polished, closely resembling the female of *D. parallelus*, with which species it may be associated in many collections, but readily distinguished by the much broader ocular canthus.

Male form F

Length, including mandibles, 13.75 mm.

Head small, with anterior and basal angles broadly rounded; mandibles arcuate, with the dorsal tooth absent, resembling in this respect the opposite sex. Prothorax slightly wider than long, with lateral sides rounded. Elytra with eighteen distinct striae of irregularly shaped, confluent punctures; interspaces highly polished, shining; lateral margins of the elytra, as well the entire upper area of the head and prothorax coarsely rugose. Color ferruginous.

*Type.*—♂; Deer Lodge, Tennessee, Aug. 10, 1932, B. Benesh, collector, and in his collection, accession number 2159.

*Paratopotype.*—1 ♂, Deer Lodge, Tennessee, July 17, 1932, (B. Benesh, collector), [Angell collection, ex-coll. B. Benesh].

Not as abundant as the two former forms described.

The three female forms here described, appear to be more constant in their sculpture, with mandibles showing very little variation in shape and dentition. They differ from *parallelus* in striation of the elytra and the absence of the vestiture on the mesosternum and metasternum; the puncturation on the venter is much more impressed and the legs are linearly punctulate, with the exterior edges covered with short, golden setae.

Female form A

Length, including mandibles, 21.75 mm.

Head transverse, rugose; two tubercles placed abreast, on a line with the eyes. Ocular canthus well pronounced in this sex, extending laterally beyond the eyes. Prothorax broader than long, laterally rounded, basal angles broadly rounded; lateral areas and the base are rather closely covered with large punctures. Elytra longer than the head and prothorax taken together, with fourteen regular striae, extending nearly to the humeri, laterally confused, rugose. Color nearly pitch-black, very feebly shining.

*Type.*—♀; Deer Lodge, Tennessee, June 23, 1932, B. Benesh, collector, and in his cabinet, accession number 2161.

*Paratopotype.*—1 ♀; Deer Lodge, Tennessee, June 17, 1932, (B. Benesh), [Angell collection, ex-coll. B. Benesh].

Examples of this form closely resemble the females of our *D. parallelus*, with which, no doubt, they are confused in many collections.

Female form B

Length, mandibles included, 18.5 mm.

Similar to the preceding, with the exception that the head is more flat frontally, the discal cephalic tubercles absent or nearly obsolete, and anterior to the eyes a raised, well-defined, nearly impunctate tubercle, situated midway between the eyes and the mandibular base. Head, prothorax and the lateral margins of the elytra, rugose. Elytra with sixteen regular striae, confluently punctate, second and third striae (from the suture) encroaching on each other in the first-third from the base, forming there nearly a complete juncture. Body distinctly more depressed than in the preceding form, of a clear ferrugineous color, shining.

*Type.*—♀; Nord Amerika, [Nagel collection, ex-coll. Albers].

*Paratypes.*—1 ♀, Deer Lodge, Tennessee, June 23, 1936, B. Benesh, collector and in his cabinet, accession number 3612. 1 ♀; Deer Lodge, Tennessee, July 10, 1932, (B. Benesh), [Angell collection].

The figure on plate I, lower row, fifth from the left, closely resembles this form. Unfortunately, this insect was not included in the lot, sent by the Academy of Natural Sciences for examination.

Female form C

Length, mandibles included, 14.75 mm.

This lilliputian form differs from its nearest relative by the extreme rugous head, prothorax and lateral margins of the elytra. Each elytron with nine distinct striae of confluent punctures, these extending to the humerus, thence with marginal area closely rugulose. The anterior tibiae are much more spatulate with four strongly developed spines, spaced equally. It is dark chestnut-brown, highly polished, shining.

*Type.*—♀; Deer Lodge, Tennessee, Aug. 8, 1934, Wm. Pelc, collector, in the author's collection, ex-coll. E. Dluhy.

A unique, received through the kindness of Mr. Eugene Dluhy, to whom thanks are due for this interesting specimen.

From the foregoing, it will be noted that the insect varies very much in size and sculpture; the clypeus and mandibles of the males present a fine opportunity for the study of variation in the Lucanidae. The accompanying figures on plate II, illustrate some of the variations noted on the material examined; the subjoined measurements of the several types selected as representatives of the material studied will bring out the essential proportions of this insect. All measurements are in millimeters; length of mandibles is figured from the base, diagonally to the tip; over-all length is taken with the mandibles in repose (clinched); width of the head, prothorax and elytra, at their widest points.

*Measurements of the forms of Dorcus Brevis*

| | | Head | | | Prothorax | | Elytra | |
|---|---|---|---|---|---|---|---|---|
| Type | Length[16] | width | length | Mandibles | width | length | width | length |
| ♂ form A | 27.5 | 11.0 | 5.5 | 4.75 | 11.25 | 5.5 | 10.25 | 12.75 |
| ♂ form B | 26.0 | 9.75 | 4.75 | 5.0 | 10.5 | 5.25 | 9.9 | 12.25 |
| ♂ form C | 23.0 | 7.5 | 4.0 | 3.75 | 9.0 | 5.0 | 8.25 | 11.5 |
| ♂ form D | 19.0 | 6.0 | 3.0 | 2.75 | 7.5 | 4.75 | 7.75 | 9.5 |
| ♂ form E | 16.75 | 4.75 | 2.25 | 1.75 | 6.25 | 4.5 | 6.5 | 8.75 |
| ♂ form F | 13.75 | 4.25 | 1.75 | 1.25 | 5.5 | 3.25 | 5.75 | 8.0 |
| ♀ form A | 21.75 | 6.25 | 3.0 | 2.5 | 8.5 | 5.5 | 8.75 | 11.5 |
| ♀ form B | 18.5 | 5.5 | 2.5 | 2.0 | 7.5 | 4.25 | 7.5 | 10.25 |
| ♀ form C | 14.75 | 4.25 | 1.75 | 1.25 | 6.25 | 3.25 | 6.0 | 8.0 |

The antennae of *D. brevis* (Pl. I, fig. 4) are more slender and longer than those of *parallelus;* scape slightly shorter than the funicle and clava combined. Joints two to six cylindrical, glabrous; second slightly longer than the third, third to sixth of equal length, dilated apically, seventh prolonged to a point, all glabrous; clava of three leaflets, joints eight and nine prolonged anteriorly to a lobe, which is rounded and covered with fine dense pubescence, opaque on prolongation, base of joints glabrous. Tenth joint spherical, covered entirely with spongy pubescence, opaque; prolongations of joints eight, nine and the tenth, flattened.

The variable clypeus of the males is prolonged into a process, which is usually wide, truncate and feebly emarginate; in the females is more constant, narrow, prolonged to a point, whereas in *D. parallelus* this is wide and short, with a frontal excavation. Mandibles in the females differ by being unidentate in *D. brevis,* bidentate in *parallelus.* The humeral spine (Pl. I, fig. 2) is drawn from the female supplied by Mr. Löding, showing the hook-like process which Albers mentioned in his description, whilst the shape of the average spine is outlined by broken lines.

One adult male was captured by the writer while feeding on the exuding juices of a badly decomposed log; Mr. Löding reports that he has taken one male at sap of an oak, whilst Dr. Lutz collected one male in a syrup trap. During the authors four-month sojourn in the Cumberland Mountains of Tennessee, a fine series of this supposedly rare insect was taken, all under deeply embedded logs; although lights were used extensively, none were attracted to them.

---

[16] Including mandibles.

The larva is scarabiform, similar to that of *D. parallelus,* with larger and darker mandibles; it feeds on the decomposing logs of white oak (*Quercus alba* L.). The pupa (only female sex known) closely resembles that of *parallelus,* distinguished from it, however, by the broad quadrate pronotum, which is feebly rounded in front, and the mandibles much larger with their tips obtusely rounded. One pupa taken in company with an adult male, on July 30th, emerged on August 15th; the emerged female was kept alive and used to September 11th in cage for attraction of the males, with negative results. It is very probable that when the male pupa is discovered it will be found that the pigtail-like caudal appendage of *D. parallelus* will be wanting. The adults appear to be hibernating, as one dormant adult male secured early in April, 1935 had one posterior tibiae broken or bitten off, indicating a " hard campaign " in his cycle of life.

### *Distribution of Dorcus brevis*

ALABAMA: *June* 8, 1924, Aug. 21, 1928, (H. P. Löding). GEORGIA: Clayton, June 1909, (W. T. Davis). ILLINOIS: Olive Branch, May 10, 1907, May 24, 1907, (C. N. Barber). INDIANA: no other locality data, the example in the American Museum of Natural History, New York. MISSISSIPPI: Meridian, July 5, (H. Soltau). MISSOURI: [Oberthür Collection, ex-coll. Kuwert]. NEW JERSEY: Engelwood, Oct. 23, 1921, (J. W. Angell); Lakehurst, Aug. 16, 1912, (Dr. F. E. Lutz); Aug. 15, 1914, (F. M. Schott); Aug. 18, 1930, (Chas. O. Ballou, Jr.); Ortley, (Geo. Angell). NORTH CAROLINA: Littleton, June 6, 1902, (F. Sherman); "N.C.", [ex-coll. Geo. Angell]; "N.C.", [Oberthür Collection, ex-coll. J. Thomson]; Raleigh, late Aug., Oct., (F. Sherman). OKLAHOMA: Ottawa Co., June 6, 1931, (Costner & Davis). SOUTH CAROLINA: Jocassee, Nov. 6, 1927, (D. Dunavan); Meredith, July 12, 1926, (O. L. Cartwright); Mountain Rest, Aug. 3, 1927, (F. Sherman). TENNESSEE: Deer Lodge, Apr. 26 to Oct. 10, 1932, (B. Benesh); Signal Mountain, Sept. 11, 1922, (C. F. Dalman). VIRGINIA: Cape Henry, Sept. 4, 1926; Newport News.

**Dorcus parallelus** (Say) (Pls. I, II, III.)

1824. *Lucanus parallelus* Say. Jour. Acad. Nat. Sci. Phila., III, p. 248.

An insect of wide distribution in the eastern half of the Boreal America, showing many variations in its extensive range. Long series of this insect prove that some of the varietal or subspecific names have an unequal standing and should be suppressed. Among these can safely be placed *Dorcus nanus* Casey;[17] the characters given, which are supposed to distinguish it from *parallelus*, apply equally well to the latter; the small arcuate mandibles, the described tarsal sculptural differences, do not separate this insect sufficiently to warrant a subspecific name. Dr. Chapin fully agrees with this view, as he wrote: "I had a need to examine the type some years ago and at that time I felt sure that the specimen is no more than a dwarf *D. parallelus.*" Mr. Angell, who is making a special study of our Dorcinae, favors the retention of this subspecies on the grounds that it may be a western phase of *parallelus*. This is at variance with field observations of the writer, who at one time has taken a fine series of *parallelus*, under the bark of a stump, consisting of twenty-seven adults. In this lot, all imaginable and described forms, subspecies, etc., were represented. This eliminates the possibility that one form or subspecies will occur in certain localities, as this single capture conclusively proves the short-comings of these variations. As far as known, the form *nanus* can and will be found throughout the range of *parallelus*, being in fact nothing but an example as to what degree an insect can retrograde. The form *carnochani* Angell[18] represents an exceptionally smooth large *parallelus*. It cannot be taken as an eastern form of the latter, as intimated. Three examples of this form in the author's collection, taken at widely separated localities (Northern Illinois, Ohio and Tennessee), disprove the claim that this form is confined solely to the East. In his description of this form, Mr. Angell compares it with *parallelus*, and states that it shows close affinity to *brevis*. The form, however, has nothing in common with the latter, being in fact, as already pointed out, an exceptionally large male with the elytra nearly smooth.

The genitalia (Pl. II, figures 6 and 7) clearly indicate the distinctness of the two species. The aedeagus in *parallelus* is much longer, of lanceolate form, apex diagonally truncate. In

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[17] Can. Ent., XLI, p. 278, (1909).

[18] Bull. Brooklyn Ent. Soc., XI, p. 70, (1916).

*brevis,* it is of a nearly like shape, differing however, in the gradually tapered end, with three lateral serrations. The inferior parameres are subconical in *brevis,* flattened and warped (twisted) in *parallelus.* Dr. Didier[19] illustrates genitalia, supposedly that of *D. parallelus,* which appears to differ materially from those here figured. The aedeagus seems to be much longer, than any the writer has had the opportunity to examine, with the apex suddenly dilated and truncate; however, as Sharp and Muir, in their study of the "Male genital tube in Coleoptera"[20] state: "the flagellum is clearly not of great morphological importance" it can be safely assumed that we have here nothing but a specimen with deformed or abnormal genitals.

### Genus **PLATYCERUS** Geoffroy

1762. Hist. Ins. Env. Paris, p. 62.

This genus, carried in our systematic lists as a Dorcinid, is not a member of this subfamily, but must be assigned a place for itself; according to Burmeister, followed by Westwood, all the Dorcinids are distinguished by three jointed antennal clubs, and the females have a hook-like appendage on the internal lobe of the maxillae. Oberthür and Houlbert[21] proposed for this genus a subfamily Platycerinae, giving as its distinctive character: "six ventral segments of the abdomen distinctly visible, eyes entire". As we have, however, members of this genus with three and four-jointed clava, we can add to this subfamily the South-African *Colophon,* of which genus Peringuey writes: "the basal abdominal segmentis produced between the hind coxae into a long cuneiform process slightly impressed transversely and representing probably an absorbed sixth ventral segment". We have here two genera closely related, which we can safely consider as homogeneous, although widely separated geographically.

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[19] Etudes Col. Lucan. du Globe, Paris, 1931, p. 177.

[20] Trans. Ent. Soc. of London, 1912, p. 629.

[21] Insecta, III, p. 217, (1913).

## EXPLANATION OF PLATES

### PLATE I

Fig. 1.—*Dorcus parallelus* (Say). Right posterior angle of prothorax and humerus, (♀).

Fig. 2.—*Dorcus brevis* (Say). Right posterior angle of prothorax and humerus, (♀).

Fig. 3.—Antenna of *Dorcus parallelus*, ♂.

Fig. 4.—Antenna of *Dorcus brevis*, ♂.

Fig. 5.—Head of *Dorcus parallelus*, ♀.

Fig. 6.—Head of *Dorcus brevis*, ♀—form B.

Fig. 7.—Head of *Dorcus brevis*, ♂—form F.

Fig. 8.—Head of *Dorcus brevis*, ♂—form B.

### PLATE II

Figures a to p, variation of clypeus in males of *Dorcus brevis*

Fig. 1.—*Dorcus brevis*, ♂—form A.

Fig. 2.—*Dorcus brevis*, ♂—form B.

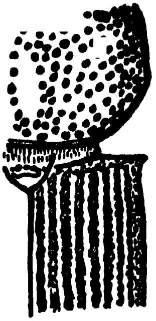
Fig. 3.—*Dorcus brevis*, ♂—form D.

Fig. 4.—*Dorcus brevis*, ♂—form E (intermediate development).

Fig. 5.—*Dorcus brevis*, ♂—form F.

Fig. 6.—Genitalia of ♂ *Dorcus parallelus*. D = dorsal view. L = lateral view (left side).

Fig. 7.—Genitalia of ♂ *Dorcus brevis*.



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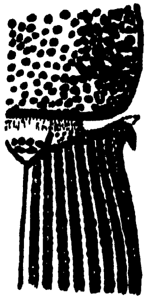

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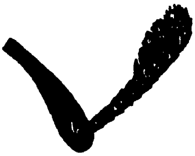

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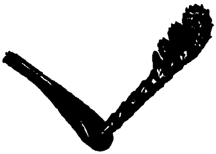

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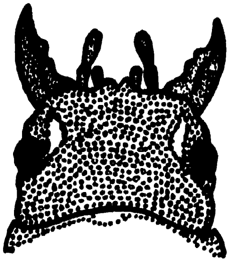
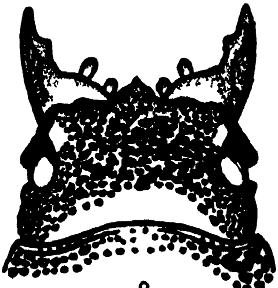
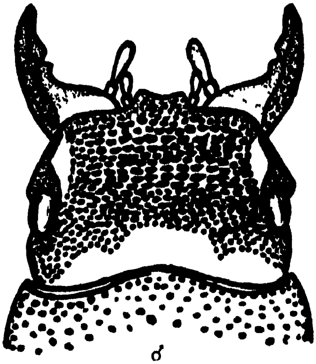


♀

5

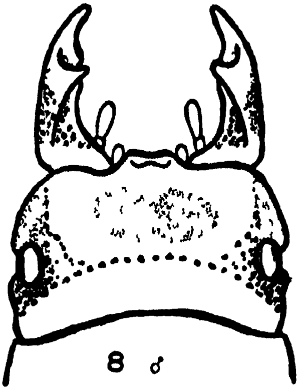


6 ♀



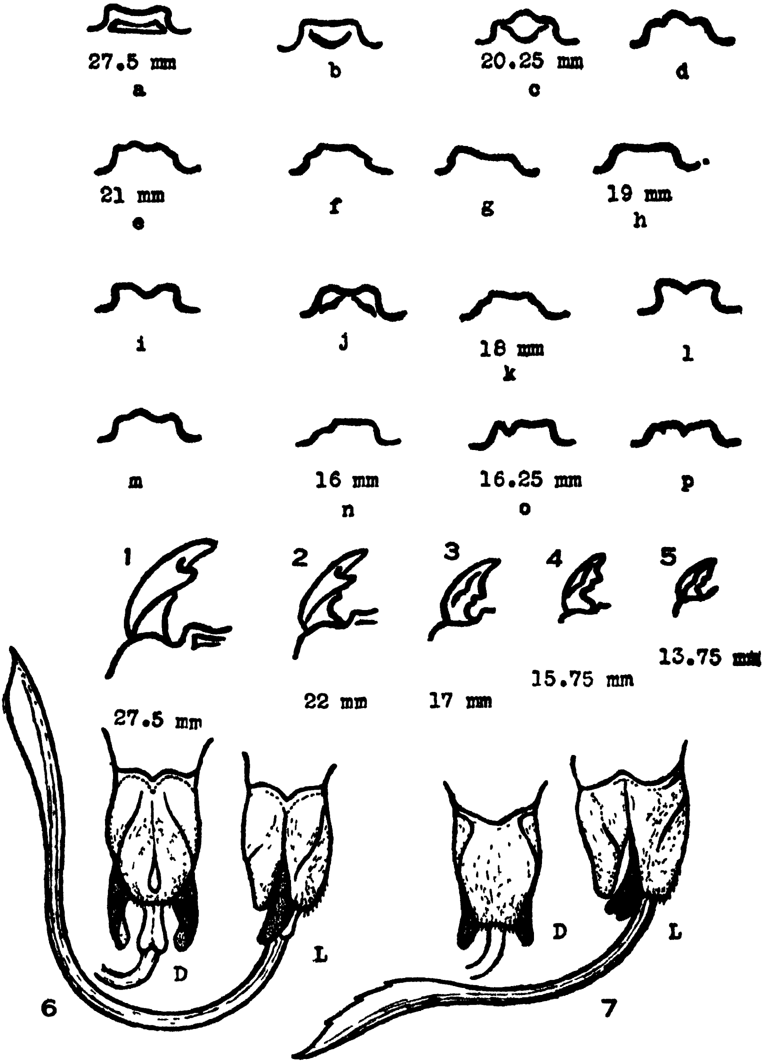
♂

7

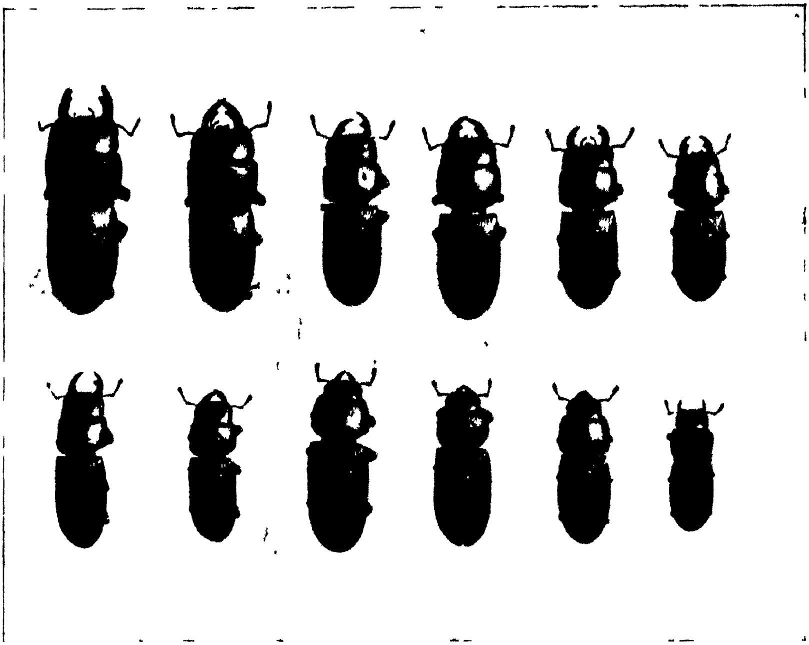


8 ♂

BENESH—AMERICAN DORCINAE



BENESH—AMERICAN DORCINAE



Top row, left to right:

*Dorcus brevis* (Say), ♂ form A.
*Dorcus brevis* (Say), ♂ form A
near form B.
*Dorcus parallelus* (Say), ♂.
*Dorcus parallelus* (Say), ♂.
*Dorcus parallelus* (Say), ♂.
*Dorcus parallelus* (Say), ♂.

Bottom row, left to right:

*Dorcus parallelus* (Say), ♂.
*Dorcus parallelus* (Say), ♂, (= *nanus* Casey).
*Dorcus parallelus* (Say), ♀.
*Dorcus parallelus* (Say), ♀.
*Dorcus brevis* (Say), ♀.
*Dorcus* sp ♂ or ♀.

**BENESH—AMERICAN DORCINAE**

# THE BIOLOGY OF SOME MINNESOTA TRICHOPTERA[1]

BY DONALD G. DENNING

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(Plate IV, text figures)

The state of Minnesota is an ideal place for the study of Trichoptera. Within a hundred mile radius of Minneapolis and St. Paul there are hundreds of streams and lakes of all sizes. Streams vary from clear, cold, rushing spring-fed brooks to the sluggish, polluted Mississippi; the lakes likewise vary from an acre or so in extent to twenty to thirty miles in diameter. Trichoptera abound in all of these environments. In spite of the excellent opportunities available for the study of Trichoptera very little work has been done on the Minnesota fauna. The only other study dealing with Minnesota material previous to the present one is that of Elkins (1936). Most of the studies of North American Trichoptera have dealt with those species indigenous to the eastern part of the United States and Canada. Many species remain to be described from the Mississippi Valley States, the Western part of the United States and Canada. The fauna of these regions is rich in Trichoptera and is represented by comparatively little material in most insect collections.

The immature stages of Trichoptera are probably less known than the immature aquatic instars of other orders of insects. The immature stages of approximately 15% of the described North American Trichoptera have been studied up to the present time. Even those species that have been studied are not always adequately described and figured.

The great abundance of material available in this region, the dearth of information in the literature regarding the immature stages, and the need for information regarding both the immature and adult stages of Trichoptera of Minnesota led the writer to undertake the present study.

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[1] Paper No. 1474 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.

The author wishes to express his appreciation and thanks to Dr. C. E. Mickel for suggesting this study and for his valuable suggestions and encouragement. Thanks are due to Dr. Cornelius Betten and Mr. Nathan Banks for checking determinations of reared material and to Mr. Richard Daggy for material and assistance in rearing.

## PRESENT KNOWLEDGE OF THE IMMATURE STAGES

The principal papers dealing with the immature stages of Trichoptera of North America are those of Vorhies (1909), Lloyd (1921), Sibley (1926) and Betten (1934). There are, at present, approximately 600 species of adult Trichoptera described and recorded from the United States, Canada, Greenland, Central America and the West Indies. Rearings by Elkins (1936) and rearings reported here will bring the total number of descriptions of immature stages of North American Trichoptera up to 73.

The species of which the immature stages are known are listed below with references to the descriptive literature.

1. *Acrocentropus lucidus* (Hagen). Betten, 1901, p. 565; Sibley, 1926, pp. 103, 208.
2. *Agapetus minutus* Sibley. Sibley, 1926, p. 203.
3. *Agraylea multipunctata* Curtis. Morton, 1886, p. 269; Silfvenius, 1904, p. 6; Siltala, 1907, p. 386; Ulmer, 1909, pp. 204, 225, 293; Sibley, 1926, pl. 10, fig. 64; Betten, 1934, fig. 37h, pl. 10, figs. 7–11, pl. 11, figs. 1, 2, 5; the present report.
4. *Agrypnia straminea* Hagen. Elkins, 1936, p. 665, pl. 1, fig. 1, pl. 4, figs. 1–6.
5. *Alepomyiodes wisconsinenesis* (Vorhies). Vorhies, 1909, p. 686.
6. *Anabolia bimaculata* (Walker). Betten, 1934, figs. 33e, 36c, 46c, pl. 50, fig. 9, pl. 51, figs. 1–3; the present report.
7. *Anabolia simplex* (Banks). Muttkowski, 1915, pls. 42–45, 2 figs.
8. *Anabolina canadensis* (Banks). The present report.
9. *Anabolina submonilifer* (Walker). Vorhies, 1909, p. 667; Lloyd, 1921, p. 51; the present report.
10. *Arctoecia consocia* (Walker). Lloyd, 1921, p. 53; Betten, 1934, figs. 46a, 48a, pl. 43, fig. 5–8.
11. *Athripsodes ancylus* (Vorhies). Vorhies, 1909, p. 692; Lloyd, 1921, p. 96.
12. *Athripsodes annulicornis mentiens* (Walker). Vorhies, 1909, p. 689.
13. *Athripsodes resurgens* (Walker). Betten, 1934, figs. 38h, 40i–l, pl. 35, fig. 6–7.
14. *Astenophylax argus* (Harris). Lloyd, 1915, p. 57; Lloyd, 1921, p. 57; Sibley, 1926, p. 216.

15. *Banksiola concatenata* (Walker). Hagen, 1873, p. 441.
16. *Brachycentrus fuliginosus* Walker. The present report.
17. *Brachycentrus nigrosoma* Banks. Lloyd, 1915, p. 81; Murphy, 1919, p. 154; Lloyd, 1921, p. 82; Sibley, 1926, p. 105; Betten, 1934, pl. 58, figs. 3, 4, 7, 8, 9, 10.
18. *Chilostigma difficile* (Walker). Lloyd, 1915, p. 208; Lloyd, 1921, p. 70; Sibley, 1926, fig. 106; Betten, 1934, fig. 10.
19. *Chimorrha aterrima* Hagen. Noyes, 1914, p. 259; Sibley, 1926, p. 103, 207; Betten, 1934, figs. 33g, 36d, 37b, c, 38f, 43e, 44b, pl. 16, fig. 9.
20. *Dasystegia (Jyrvia) vestita* (Walker). Lloyd, 1921, p. 35; Sibley, 1926, p. 104.
21. *Diplectrona modesta* Banks. Betten, 1934, p. 183, pl. 17, figs. 5–7.
22. *Dolophilus breviatus* Banks. Betten, 1934, pl. 16, figs. 3–4.
23. *Eubasilissa pardalis* (Walker). Lloyd, 1915, p. 201; Lloyd, 1921, p. 20.
24. *Eustenace gentilis* (McLachlan). Sibley, 1926, pp. 107, 218.
25. *Genonema nigrum* Lloyd. Lloyd, 1915, p. 18; Lloyd, 1921, p. 87; Betten, 1934, p. 235, pl. 26, figs. 5–14, pl. 27, figs. 1–6.
26. *Glyphotaelius hostilis* Hagen. Lloyd, 1921, p. 43; Sibley, 1926, p. 107.
27. *Goera calcarata* Banks. Lloyd, 1921, p. 80; Sibley, 1926, p. 106; Betten, 1934, pl. 61, figs. 7–9 (?).
28. *Grammotaulis bettenii* Hill–Griffin. Hill–Griffin, 1912, p. 18.
29. *Helicopsyche borealis* Hagen. Hagen, 1864, p. 130; Packard, 1869, p. 160; Vorhies, 1909, p. 682; Lloyd, 1921, p. 77; Sibley, 1926, p. 106; Betten, 1934, p. 416, figs. 36f, 37g, 49a, b, pl. 66, figs. 8–10, pl. 67, figs. 1–5; Elkins, 1936, p. 672, pl. 1, fig. 10, pl. 6, fig. 2–5.
30. *Hesperophylax designatus* (Walker). Marshall and Vorhies, 1905, p. 232; Vorhies, 1905, p. 108; Vorhies, 1909, p. 674; Lloyd, 1921, p. 63; Betten, 1934, pl. 53, figs. 2–3; Elkins, 1936, p. 671, pl. 1, fig. 5, pl. 5, figs. 1, 3, 4; the present report.
31. *Hydropsyche alternans* (Walker). Vorhies, 1909, p. 709; Betten, 1934, figs. 33f, 34c, 36b, 37d, e, 38g, 48b, pl. 18, figs. 4–7.
32. *Hydropsyche incommoda* Hagen. Betten, 1934, pl. 19, fig. 3.
33. *Hydropsychodes analis* (Banks). Betten, 1934, p. 195, fig. 40h, pl. 20, figs. 10–13; Elkins, 1936, p. 659, pl. 1, fig. 7, pl. 2, figs. 1–9.
34. *Leptocella albida* (Walker). Vorhies, 1909, p. 697; Betten, 1934, figs. 33c, 37j, k, 49c, pl. 32, fig. 14, pl. 33, figs. 1–8; Elkins, 1936, p. 664, pl. 1, fig. 8, pl. 3, figs. 1, 2, 3, 5, 8.
35. *Leptocerus cancellatus* Betten. Elkins, 1936, p. 661, pl. 1, fig. 9, pl. 3, figs. 4, 6, 7.
36. *Limnephilus combinatus* Walker. Vorhies, 1909, p. 661; Lloyd, 1915, p. 203; Lloyd, 1921, p. 44; Elkins, 1936, p. 668, pl. 1, fig. 3, pl. 6, fig. 1.
37. *Limnephilus despectus* Walker. Silfvenius, 1902, p. 68.
38. *Limnephilus indivisus* Walker. Simpson, 1903, p. 98; Lloyd, 1915, p. 205; Lloyd, 1921, p. 47.
39. *Limnephilus tersus* Betten. Betten, 1934, pl. 46, fig. 8, pl. 47, figs. 1–5.

40. *Macronema zebratum* Hagen. Betten, 1934, p. 206, figs. 33d, 36e, 37a, 38b, 40e, f, g, pl. 21, fig. 15, pl. 22, figs. 1–7.
41. *Molanna (Molanneria) blenda* Sibley. Sibley, 1926, pp. 105, 210.
42. *Molanna (Molanneria) cinerea* Hagen. Betten, 1901, p. 564; Betten, 1902, p. 147; Betten, 1934, pl. 30, figs. 3–9.
43. *Molanna (Molanna) flavicornis* Banks. Neave, 1933, p. 24; the present report.
44. *Molanna (Molanna) uniophila* Vorhies. Vorhies, 1909, p. 705.
45. *Mystacides alafimbriata* Hill-Griffin. Hill-Griffin, 1912, p. 19.
46. *Mystacides longicornis canadensis* Banks. The present report.
47. *Mystacides sepulchralis* Walker. Lloyd, 1921, p. 98; Betten, 1934, pl. 38, figs. 1–13.
48. *Mystrophora americana* (Banks). Lloyd, 1921, p. 116; Sibley, 1926, p. 102; Betten, 1934, figs. 34b, 37i, 38e, pl. 9, figs. 6–7.
49. *Neophylax concinnus* McLachlan. Vorhies, 1909, p. 669; Lloyd, 1921, p. 72.
50. *Neophylax fuscus* Banks. Betten, 1934. fig. 40o, pl. 55, figs. 6–12.
51. *Neureclipsis bimaculata* (Linnaeus). Silfvenius, 1903, p. 11; Ulmer, 1903, p. 147; Siltala, 1907, p. 407; Wesenberg-Lund, 1911, p. 7.
52. *Oligostomis ocelligera* (Walker). Lloyd, 1921, p. 26; Sibley, 1926, p. 104.
53. *Phanopsyche grisea* Banks. Sibley, 1926, p. 106, 212.
54. *Philopotamus distinctus* Walker. Betten, 1934, p. 167, pl. 15, figs. 9–12.
55. *Phryganea (Neophryganea) cinerea* Walker. Hagen, 1873, p. 439; Lloyd, 1921, p. 30; Neave, 1933, p. 18.
56. *Phryganea (Neophryganea) sayi* Milne. Vorhies, 1909, p. 655; Lloyd, 1921, p. 32; Sibley, 1926, p. 104; Betten, 1934, figs. 43d, 44e, 46b.
57. *Phylocentropus maximus* Vorhies. Vorhies, 1909, p. 711.
58. *Phylocentropus placidus* (Banks). Betten, 1901, p. 565; Betten, 1934, figs. 37o-p, 40n, 48c, pl. 23, figs. 6–8.
59. *Platycentropus indistinctus* (Walker). Betten, 1934, pl. 51, figs. 7–8; the present report.
60. *Platycentropus maculipennis* (Kolenati). Betten, 1901, p. 567; Lloyd, 1921, p. 68; Sibley, 1926, pp. 106, 216; Betten, 1934, fig. 43a, pl. 51, fig. 11.
61. *Polytrichia confusa* (Morton). Lloyd, 1915, p. 117.
62. *Ptilotomis postica* (Walker). Vorhies, 1909, p. 659; Lloyd, 1921, p. 22; Sibley, 1926, pl. 8, fig. 36, pl. 10, fig. 68, pl. 12, figs. 93–94; Betten, 1934, figs. 33b, 34f, 39.
63. *Rhyacophila carolina* Banks. Betten, 1934, p. 128, figs. 37f, 44c, d.
64. *Rhyacophila fuscula* (Walker). Lloyd, 1921, p. 112, figs. 184–189; Betten, 1934, p. 130, figs. 34a, 37l, 38a, 42a, b, 43c, 44a.
65. *Rhyacophila lobifera* Betten. Betten, 1934, p. 131, figs. 36a, 37n, 45, pl. 6, figs. 11–14.
66. *Rhyacophila torva* Hagen. Vorhies, 1909, p. 713; Lloyd, 1921, p. 114.

67. *Stenophylax guttifer* (Walker). Lloyd, 1921, p. 67; Sibley, 1926, pp. 107, 218; Betten, 1934, p. 349.
68. *Stenophylax luculentus* Betten. Betten, 1934, p. 345, pl. 48, figs. 10–12, pl. 49, figs. 1–4.
69. *Stenophylax scabripennis* (Rambur). Lloyd, 1921, p. 60; Sibley, 1926, pp. 108, 219.
70. *Stenophylax subfasciatus* (Say). Vorhies, 1909, p. 679; Sibley, 1926, p. 217; Elkins, 1936, p. 669, pl. 1, fig. 4, pl. 5, fig. 2.
71. *Trianodes marginata* Sibley. Sibley, 1926, pp. 105, 209.
72. *Trianodes vorhiesi* Betten. Vorhies, 1909, p. 703.
73. *Ymymia americana* (Banks). Vorhies, 1909, p. 699; Lloyd, 1921, p. 102; Betten, 1934, figs. 40m, 41b, pl. 36, figs. 3–6.

## REARING TECHNIQUE

The relative lack of knowledge of immature stages of Trichoptera is probably due to the difficulty in rearing and transporting the larva or pupae. A heavy mortality in transporting the larvae or pupae is bound to occur due to the exhaustion of the oxygen content in the water. This is especially true if they are transported for any great distance. Attempts were made to transport larvae or pupae wrapped in damp leaves or moss with varying success. The most successful method is to collect a small number of larvae or pupae in a pint jar partly filled with water and to change the water every hour or two.

Larvae or pupae successfully taken to the laboratory were placed in large culture dishes, six inches in diameter and two inches deep, and filled with water. Sand and small pebbles were added to cover the bottom of all containers, not only to provide material for case building, but also to provide a firm footing for the larvae. Small sticks, leaves, grass and other debris were also provided for case building and a partial food supply.

Water in which larvae or pupae are being reared must be kept well aerated. The water need not be flowing or especially fresh. Each container must be cleaned and clean water added every two or three days. Tap water was used in all rearings. The water was kept well aerated by passing a steady stream of fine air bubbles through it. Air under pressure was carried into each container by a series of brass or glass T's, each connected to the source of air supply by rubber tubing. The stem of this T was plugged with a piece of balsam wood, immersed in the water, and the air forced through it came out as a mass of fine bubbles. A small amount of air continuously applied is all that is necessary. A large series of containers, each connected to its neighbor by rubber tubing, may be run at the same time.

When adults are ready to emerge, the container may be enclosed by a wire screen and covered with a piece of cheese cloth.

*Apparatus and its Arrangement used in Rearing Trichoptera*

Small pieces of green lettuce, weighted to the bottom of the container proved to be an ideal food for herbivorous larvae. Carrots can be substituted for lettuce but are not as easily handled. Only a few larvae should be placed in a single container due to the fact that they are more or less carnivorous, and under overcrowded conditions readily attack one another.

The advantages of the above method of rearing are:

1. The water can be kept well aerated. 2. The containers are easily kept clean. 3. A large series of containers can be run at one time. 4. The larvae are easily fed. 5. The larvae can be observed and studied. 6. The cast skin and adult are easily matched. 7. The screen serves as a good place for emerging adults. 8. The container can be divided into two or more parts by a screen partition and different species segregated.

**Anabolina canadensis** (Banks) (Figs. 1-5; pl. IV, fig. 42.)

Adult

1908. *Limnephilus* (*Goniotaulius*) *canadensis* Banks, Trans. Amer. Ent. Soc., xxxiv, p. 264, pl. 18, fig. 4.

1934. *Limnephilus canadensis* Betten, N. Y. State Mus. Bul., 292, p. 321.

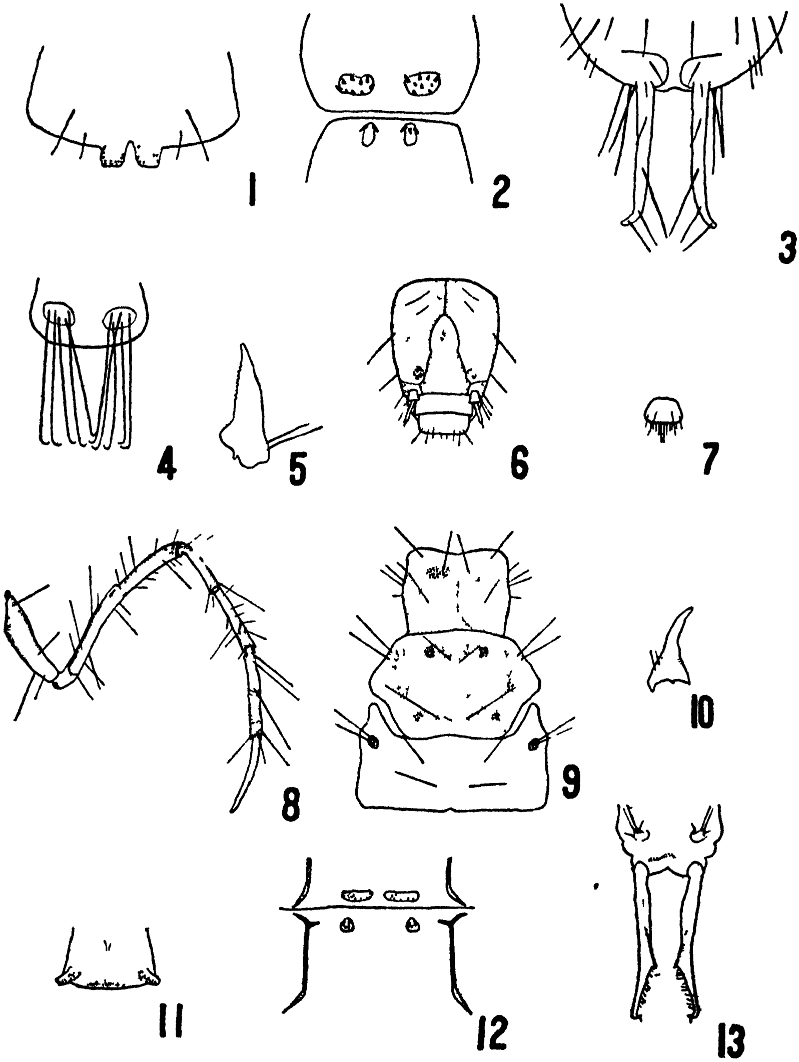
1935. *Anabolina canadensis* Milne, Stud. N. A. Trichop., pp. 41, 49.

*Habitat.*—Pupal cases collected from submerged logs, stones and surface of the gravelled bed of Pine River, near the town of Pine River, Minnesota, June 2, 1935. This is a moderately swift stream. Taken to the laboratory, twenty adults emerged from June 11 to 14.

*Pupa.*—Length, 11 to 14 mm. Color reddish brown. Two black setae, sub-equal, on outer edge near base of each mandible (Fig. 5). Labrum with ten stiff, black hooked setae arising near anterior margin, arranged in two groups of five each. Number, position and arrangement constant in all specimens examined (Fig. 4).

Lateral line of thick, dark brown hairs extending from posterior margin of abdominal segment V to ventral surface of segment VIII. Dorsal posterior margin of first abdominal segment divided into two blunt spinulate processes with two pairs of setae cephalo-lateral to these processes (Fig. 1). Dorsal plates on abdominal segments III to VII inclusive. Plates on segment III approximately one-half the size of those on segments IV to VII. Dorsal plates vary slightly in size, shape and position, with two to four points, three on the majority. Individual variations in number of points common; one plate with three points, the opposite two to four, more often two points (Fig. 2). Generally one point on each anterio-lateral margin, the third (if present) mesad and a little caudad of the anterior pair. Second pair of plates on segment V with eight to ten, usually nine points. Arrangement of points differ, varying on opposite sides of the same individual. Anterior four or five points always the largest. The shape of the plate may vary, but size approximately the same in all pupae examined (Fig. 2). Anal appendages long, slender, divergent at tips, with two black setae at tips (Fig. 3).

*Pupal case.*—Length, 13 to 17 mm., majority, 14½ mm. Greatest width 4 to 5 mm. Case composed of small irregular grains of sand fitted closely together, except at anterior end the sand granules more loosely joined. Generally larger grains of sand at the anterior end. Cases slightly curved in the center. (Pl. IV, fig. 42.)



*Anabolina canadensis* (Banks).—Fig. 1.—Abdominal segment I of pupa. Fig. 2.—Abdominal segment V and VI of pupa. Fig. 3.—Anal segment of pupa. Fig. 4.—Labrum of pupa. Fig. 5.—Mandible of pupa.

*Mystacides longicornis canadensis* Banks.—Fig. 6—Head of larva. Fig. 7.—Labrum of pupa. Fig. 8.—Hind leg of larva. Fig. 9.—Prothorax, mesothorax and metathorax of larva. Fig. 10.—Mandible of pupa. Fig. 11.—Abdominal segment I of pupa. Fig. 12.—Abdominal segment V and VI of pupa. Fig. 13.—Anal segment of pupa.

**Mystacides longicornis canadensis** Banks (Figs. 6-13; pl. IV, fig. 44.)

Adult

1924. *Mystacides canadensis* Banks, Bul. Mus. Comp. Zool., LXV, p. 448, pl. 4, fig. 47.
1934. *Mystacides canadensis* Betten, N. Y. State Mus. Bul., 292, p. 279.
1934. *Mystacides longicornis interjecta* form *canadensis* Milne, Stud. N. A. Trichop., pp. 13, 18, 19.

*Habitat.*—Larval and pupal cases collected from a sandy beach at DeSota Lake, Itasca Park, Minnesota, June 1, and from the gravelled bed of Pine River, near the town of Pine River, June 2, 1935. In the laboratory adults emerged in fifteen to twenty days. The vast majority of the cases collected were empty. In fifty-five cases collected, there were one larva and seven pupae. Six adults, one female and five males, emerged.

*Larva.*—Length of the one larva examined, 9 mm., length of head, 1 mm. Head light brown with dark brown markings (Fig. 6). Clypeus very light, almost clear; labrum dark brown. Eight setae along anterior margin of labrum (Fig. 6). Ventral side of head dark brown, without markings.

Prothorax and mesothorax light brown with dark brown markings (Fig. 9). Pronotum slightly broader than head. Metathorax membranous. Two setae on small plate of "shoulder" of metathorax.

Fore legs broad, flat; light yellow except for a dark brown dorsal edge. Middle legs light yellow, joints dark brown, dorsal and ventral margin of trochanters dark brown. Bristle at base of tarsal claw long and sharp, as long as basal tarsal segment. Hind legs light yellow; dark brown markings as on middle legs (Fig. 8). Near middle of basal tarsal joint a slight swelling accompanied by a clear colored ring. Tarsal claw slightly shorter than basal tarsal joint. Tibia appears divided near middle of segment. However, Lloyd (1921, p. 99) in his study of the hind tibia of *M. sepulchralis* (Walker) concluded that there is no suture present at this apparent division. Femur divided into a short basal and a long apical piece. Near middle of apical part of femur a distinct swelling.

First abdominal segment with prominent dorsal spacing hump; lateral humps smaller. Light brown plate on ventro-caudal side of each lateral hump. A black line extends caudad from dorsal margin of this plate; and near ventral edge a long and a short, black seta.

*Trachacl gill Formula*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| **Dorsal** | | ● ● | ● | ● | ● | ● | | | |
| **Ventral** | | ● ● | ● ● | ● ● | ● ● | ● ● | ● ● | ● | |

Lateral line, of weak pale hairs, extending from anterior portion of abdominal segment III to VIII. Anterior portion of lateral line a single row of tiny points which gradually increase in length until they appear as distinct hairs near the caudal margin of segment III. Lateral line tapering to a single line of prominent points; entire lateral line on segment VIII composed of these points. Anal furrow bordered entire length by many fine points. Row of stout, short, thickly-set light brown setae midway between anal furrow and prolegs. Prolegs small, heavily sclerotized with two light brown hooks.

*Pupa.*—Length of 5 pupae examined 9.5 to 10 mm. Antennae coiled around basal half of anal appendages. Mandibles with inner margin concave, very finely serrate, serration not extending to tip; two small setae near basal, outer margin of mandible (Fig. 10). Labrum very small, narrowing toward base. Anterior margin of labrum crenate. Margin of labrum with two large setae in center and five smaller bristles to each side (Fig. 7).

Latero-posterior margin of first abdominal segment extended into two dorsal processes. Lower inner surface of processes covered with small points. Mesad to these processes and near posterior margin a line of closely set tiny points. Two setae near center of segment (Fig. 11). Dorsal plates on abdominal segments III to VI inclusive, with two to four points. Second pair of plates on segment V with nine to twelve points irregularly arranged; these plates wide and narrow in all five pupae examined (Fig. 12). Lateral line of pale weak hairs, extending from anterior margin of segment III to ventral side of segment VIII. Single tracheal gills on segment II to VI inclusive. Anal appendages long slender rods slightly over one millimeter long. Anal appendages suddenly begin to narrow to a sharp hook at approximately two-thirds their length. Thin row of weak pale hairs on each anal appendage (very fine near base, longer and heavier toward center, but thinning out again near tips). Lateral margins of segment IX sinuous. A faintly sclerotized tubercle near lateral margins of segment IX. Pair of stout long setae and pair of much shorter setae arise from this tubercle (Fig. 13).

*Case.*—Cases a cylindrical slightly tapering tube of minute grains of sand. Ventral portion of case always bare, while dorsal portion is covered with small pieces of bark and Nyssa & Potamogeton seeds. In majority of fifty-five pupal and larval cases examined, bits of these seeds and bark extend beyond the anterior opening forming a small dorsal hood (Pl. IV, fig. 44). No differences in shape or composition of larval and pupal cases. One pupal case examined had an anchor of two large pebbles attached to the posterior end by strands of silk. Length of pupal and larval cases, 11 to 17 mm., the majority, 13 mm.

**Brachycentrus fuliginosus** Walker (Figs. 14-22; pl. IV, fig. 43.)

Adult

1852. *Brachycentrus fuliginosus* Walker, Cat. Neurop. Ins. in the Brit. Mus., I, p. 88.
1861. *Brachycentrus fuliginosus* Hagen, Syn. Neurop. N. A., p. 272.
1861. *Brachycentrus incanus* Hagen, Syn. Neurop. N. A., p. 272.
1864. *Brachycentrus fuliginosus* McLachlan, Trans. Ent. Soc. London, (3), I, p. 658, (footnote).
1877. *Brachycentrus fuliginosus* Provancher, Le Nat. Canad., IX, p. 261. (Petite Fauna Ent. Canada, II, p. 137, 1878.)
1907. *Brachycentrus fuliginosus* Ulmer, Genera Insectorum., Fasc. 60, pl. 10, fig. 89.
1911. *Brachycentrus incanus* Banks, Trans. Amer. Ent. Soc., XXXVII, p. 355.
1934. *Brachycentrus fuliginosus* Betten, N. Y. State Mus. Bul. 292, p. 384, pl. 57, figs. 4-9; pl. 58, figs 1, 2.
1935. *Brachycentrus numerosus fuliginosus* Milne, Stud. N. A. Trichop., pp. 113, 123.

On May 4, 1935, pupal cases of this species were collected in Nine Mile Creek, Hennepin County, Minnesota. Adults began to emerge fifteen minutes after pupal cases had been placed in a pint jar of water. Pupae swim to surface and adults emerge with wings completely developed. Adults are able to walk with ease on surface of water. Adults were removed as quickly as they emerged and placed in a dry pint jar. One hour later they began to copulate. Adults remained overnight in the jar and next morning egg masses were adhering to the sides.

*First Instar Larva.*—Head light brown. Prothorax heavily sclerotized, nearly as broad as meso- and metathorax. Prothorax colored light brown except black caudal margin. A slender curved plate, appearing as a black line, extends mesad from lateral margin of both meso- and metathorax. Only a few setae on thorax.[2] Anal proleg light brown, prominent, with three long black setae near base.

*Mature Larva.*—Average length of mature larva, 13 mm., breadth, 2 to 3 mm. Soft parts colored green, heavily sclerotized parts dark brown.

Head dark brown except for a round yellow spot encircling eye. Labrum dark brown, near anterior margin two pairs of weak black setae. Latero-anterior margin of labrum fringed with dense fine hairs (Fig. 14). Frons dark brown. cephalic portion with six stout setae. Pair of setae on latero-anterior angle of frons light colored and saber-like, extending over labrum, their tips nearly touching (Fig. 14).

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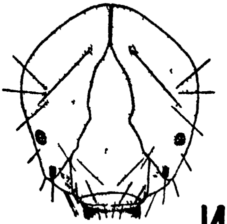
[2] Helen Murphy (1919) described the first instar larvae of *B. nigrisoma* (Banks). She found the meso- and metathorax heavily sclerotized and bearing many setae in that species.

Prothorax slightly wider than head, composed of two dark brown plates, with numerous black setae along cephalic margin. Mesothorax with four separated plates; a semicircular row of black setae formed transversely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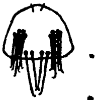
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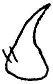
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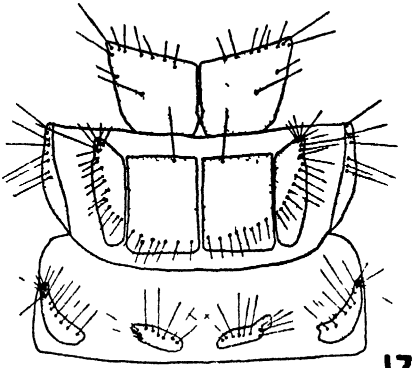
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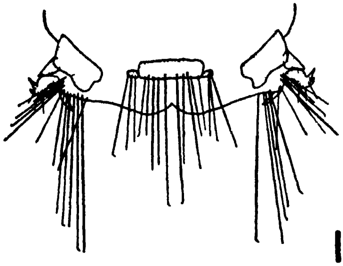
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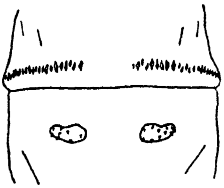
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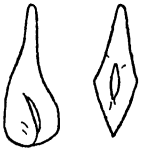
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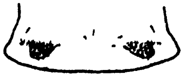
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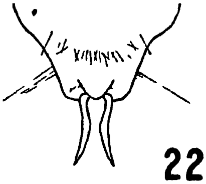
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*Brachycentrus fuliginosus* Walker. — Fig. 14.—Head of larga. Fig. 15.—Labrum of pupa. Fig. 16.—Mandible of pupa. Fig. 17.—Prothorax, mesothorax and metathorax of larva. Fig. 18.—Anal segment of larva. Fig. 19.—Abdominal segment V and VI of pupa. Fig. 20.—Enlarged view of points on Abdominal segment V. Fig. 21.—Abdominal segment I of pupa. Fig. 22.—Anal segment of pupa.

through these plates. Lateral portion of mesothorax with a dark brown plate, the edge just visible dorsally (Fig. 17). Four small plates on metathorax, somewhat variable in shape, each with a row of strong black setae along cephalic margin (Fig. 17). Legs entirely dark brown. Short, dense light colored fringe of silky hairs along inner margin of femur.

Anal segment with a broad narrow plate near center of posterior margin, on each side of this plate a small round plate about half its width. Caudal margin of plates with row of long stout black setae. Anal proleg, two segmented with three small setae; claws with two hooks. Group of five stout setae near base of proleg. Just mesad from proleg a group of eight stout, very long, black setae. A small gill-like process, without setae or sclerotized plates, extends from ventral surface a short distance near margin of proleg. Plates cephalad from base of prolegs, broader than wide, without setae (Fig. 18). Lateral line, of fine brown hairs, from segment III to VII inclusive. Row of tiny sclerotized points above lateral line in anterior portion of each segment.

The legs of *B. fuliginosus* agree very closely to those described for *B. nigrisoma* (Banks) by Lloyd (1921). The gill formula of *B. fuliginosus* differs from *B. nigrisoma*, as reported by Lloyd (1921), in having two gills on the ventral portion of segment II and one gill on the dorsal portion of segment VI.

*Pupa.*—Length, 11 to 12 mm. Labrum obtusely triangular, approximately .5 mm. in length. A pair of two stout light brown hooked setae arise from the anterior margin. Near center of lateral margins two groups of five light brown stout setae, hooked at tip. Center of caudal margin with two minute light colored setae which can be seen with a compound microscope (Fig. 15). Blade of mandible strongly sclerotized, dark brown; base light brown. Teeth on inner side very inconspicuous, coarse and blunt. Base of mandible with two weak hairs (Fig. 16).

Dorsal processes of first abdominal segment do not reach posterior margin. Processes heavily sclerotized, the two connected by a lightly sclerotized band (Fig. 21). Points on dorsal processes coarsely set, rodlike; the process having a striated appearance under the compound microscope. Directly cephalad from each process three minute hairs.

Dorsal plates on abdominal segments III to VIII with five to thirteen prominent points, majority with seven to eleven. Arrangement and number of points may vary on the individual. Points on posterior margin of segment V not borne on a single plate, instead they occur as independent sclerotized teeth forming a narrow line (Fig. 19). An enlarged view of two of these points is shown in figure 20.

Anal segment obtuse; appendages curved and slender, appearing spinulate under the compound microscope. Anal appendages without setae. Ventro-lateral margin of anal segment with group of three weak black setae (Fig. 22). Viewed dorsally anal appendages three-fourths length of anal segment.

Lloyd (1921), in his description of the pupa of *B. nigrisoma* (Banks), called attention to a narrow obliquely downward-pointing line of dark color on the ventral sides of segments I to VII; no such line could be found in any pupae of *B. fuliginosus* examined. The antennae of *B. fuliginosus* reach to segment IV; much shorter than *B. nigrisoma* (Banks) which Lloyd (1921) reported reached to tip of abdomen. Lateral line, of fine light brown hairs, as Lloyd (1921) reported for *B. nigrisoma* (Banks) extends from middle of segment V to ventral side of segment VIII.

*Case.*—Mature larval and pupal cases with sides rounded, almost round in cross section. Length, 11 to 14 mm., majority, 13 mm. Diameter of majority of cases, 3 mm. at anterior end, tapering to 2 to 2.5 mm. at posterior end. Case composed of two layers of silk, inner layer light colored and tender, outer layer thicker, tough, colored light brown. Scattered upon this outer layer small grains of sand and tiny bits of black. Dark striated appearance of case due to these bits of bark arranged horizontally. Anterior two or three millimeters of cases with grains of sand much closer together than elsewhere (Pl. IV, fig. 43). Anterior and posterior ends of case closed with a perforated membrane. Anterior membrane a circular, tough, transparent membrane of silk, two millimeters in diameter; perforated in center with a variable number of small holes arranged in a circle. Arrangement of holes may vary; in general practically the same as that figured for *B. nigrisoma* (Banks) by Lloyd (1921, fig. 148C). Membranous silk sieve closing posterior end of case very similar to anterior membrane, except diameter smaller.

*Eggs.*—Egg mass green in color, irregularly round, consisting of approximately 350 green spherical eggs, embedded in a sticky gelatinous matrix. Gelatinous outer covering thin and transparent; hairs from female abdomen, air-bubbles and sediment readily adhere to it. Diameter of five egg masses measured as follows: 4 mm., 4 mm., 3.5 mm., 3 mm., and 4 mm.

Egg masses laid on May 4 were kept in a pint jar of water in the laboratory and on May 15 larvae began to emerge. Length of first instar larvae, 1 mm., width, .25 mm. Larvae had reached a length of 2 millimeters by June 18. Cases composed of vegetation and silk, almost square in cross section. Larvae are able to swim through the water very similar to a *Trianodes* larva.

The winter is passed in the larval stage. During the latter part of April larvae prepare for pupation by closing the anterior end of their cases On April 26, 1936, collections of this species were made at Nine Mile Creek, Hennepin County, Minnesota. At this time all cases found were firmly attached to logs and debris, all with anterior ends closed; the majority already in the pupal stage.

Pupal cases lie flat against submerged logs or sticks with anterior and posterior end attached by a fringe of tough silk; broken fragments of attachment as in Fig. 43. Mature larvae apparently gregarious when preparing for pupation—several pupal cases may lie side by side, often one end or both may be attached to another case.

**Platycentropus indistinctus** (Walker) (Figs. 23-27; pl. IV, fig. 41.)

Adult

1852. *Limnephilus indistinctus* Walker, Cat. Neurop. Ins. Brit. Mus., I, p. 37.
1864. *Halesus indistinctus* Hagen, Verh. Zool. Bot. Gesell. Wien, xiv, pp. 817–818.
1877. *Halesus indistinctus* Provancher, Le Nat. Canad., ix, p. 259. (Petite Fauna Ent. Canada, II, p. 134, 1878.)
1901. *Halesus indistinctus* Betten, N. Y. State Mus. Bul. 47, pl. 30. fig. 3.
1908. *Halesus indistinctus* Banks, Psyche, xv, p. 64.
1916. *Hylepsyche indistinctus* Banks, Can. Ent., xlviii, p. 121.
1934. *Platycentropus indistinctus* Betten, N. Y. State Mus. Bul. 292, pp. 357, 358, pl. 51, figs. 4–6.
1935. *Platycentropus indistinctus* Milne, Stud. in N. A. Trichop., pp. 38, 52.

Immature stages

1934. *Platycentropus indistinctus* Betten, N. Y. State Mus. Bul. 292, pl. 51, figs. 7, 8.

This species was evidently reared by Betten (1934) who figured a pupal mandible and labrum.

*Habitat.*—Pupal cases collected from the moderately swift Partridge River, near Aldrich, Minnesota. This river has a sand-gravel bed, with many large boulders. At the time this collection was made, May 29, 1935, there was a heavy algal growth along the margin in which the pupae were taken.

*Pupa.*—Cast skins of one male and one female examined. Length of male pupa 15 mm., of female pupa, 17.5 mm.

Mandibles prominent, inner margin straight, very finely serrate to tip, two long setae near outer margin of base (Fig. 24). Labrum over twice as broad as long; with two groups of five fuscous setae, hooked at tip. Anterior margin of labrum with two small, clear setae. Light brown sclerotized areas as indicated in figure 23.[8]

Dorsal processes of first abdominal segment extend very slightly beyond posterior margin. Inner margin of processes with a few scattered minute points, the majority pointing mesad. Extending posteriorly and near each margin two bands, as heavily sclerotized as the two dorsal processes; three black bristles, on each side, arise from this sclerotized area (Fig. 25).

Dorsal plates on abdominal segments IV to VII have a slight extension arising from center of their anterior margins. Points on dorsal plates very prominent, generally along anterior margin. Second pair of plates on

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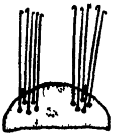
[8] Mandible and labrum figured by Betten differs from Minnesota material in certain details as a comparison of the two sets of figures will show.



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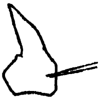

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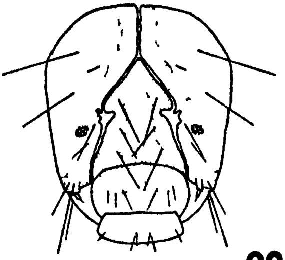

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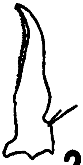

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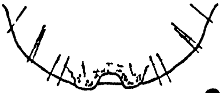

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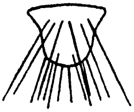

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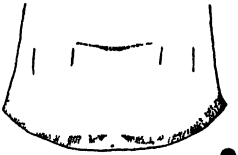

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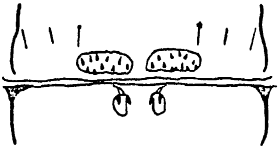

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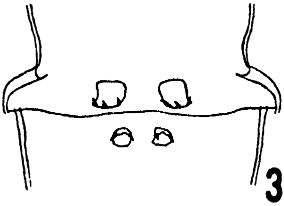

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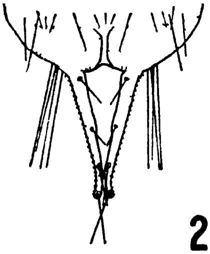

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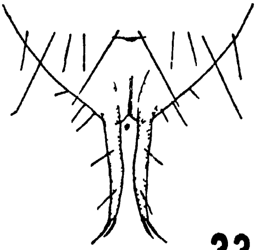

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*Platycentropus indistinctus* (Walker).—Fig. 23—Labrum of pupa. Fig. 24.—Mandible of pupa. Fig. 25.—Abdominal segment I of pupa. Fig. 26.—Abdominal segment V and VI of pupa. Fig. 27.—Anal segment of pupa.

*Molanna* (*Molanna*) *flavicornis* Banks.—Fig. 28.—Head of larva. Fig. 29.—Mandible of larva. Fig. 30.—Labrum of pupa. Fig. 31.—Abdominal segment I of pupa. Fig. 32.—Abdominal segment V and VI of pupa. Fig. 33.—Anal segment of pupa.

segment V with points prominent, irregularly arranged (Fig. 26). Points on dorsal plates of male pupa as follows: IV, 2. V, 2; 10–12. VI, 2–3. VII, 3–2. Points on dorsal plates of female pupa as follows: IV, 3–2. V, 3; 20–18. VI, 3–4. VII, 2–3.[4] Lateral line, dark brown, extends from caudal portion of segment V to ventral side of segment VIII. Pupal gills branched, on segments I to VIII inclusive.

Anal appendages slender, tapering, divergent at tips. Bulbous posterior portion of anal segment spinulate, majority of tiny spines pointing cephalad. Outer lateral portion of anal appendages spinulate, the tiny spines extending to tip. Inner margin of anal appendages coarsely serrate, the small clear teeth extending to tip. Two groups of four long black setae extend caudad from ventral surface of anal segment. Anal appendages with three black setae along inner margin; one long black seta at tip (Fig. 27).

*Case.*—Length of two pupal cases, 18 to 23 mm., diameter 5 mm. Case composed of small grains of sand, arranged in a slightly tapering, smooth cylinder. Lateral view shows slight extension of dorsal portion to form a small dorsal hood (Pl. IV, fig. 41). Anterior end closed with a thin, gelatinous silk membrane; posterior end completely closed with small grains of sand, except a small trilobed opening in center.

### **Molanna (Molanna) flavicornis** Banks (Figs. 28-33; pl. IV, fig. 45.)

Adult

1914. *Molanna flavicornis* Banks, Can. Ent., XLVI, p. 261; pl. 15, fig. 46.
1933. *Molanna flavicornis* Neave, Int. Rev. der Hydrob. und Hydrog., XXIX, pp. 24, 25, 27.
1934. *Molanna flavicornis* Betten, N. Y. State Mus., Bul. 292, p. 247, fig. 55b.
1934. *Molanna* (*Molanna*) *flavicornis* Milne, Stud. in N. A. Trichop., p. 10.

Immature stages

1933. *Molanna flavicornis* Neave, Int. Rev. der Hydrob. und Hydrog., XXIX, pp. 25–27, fig. 4.

*Habitat.*—One pupa collected in DeSota Lake, Itasca Park, Minnesota, June 1, 1935, from a sandy beach at a depth of two feet. In a quiet portion of Pine River, near the town of Pine River, Minnesota, one larva and four pupae were collected June 2, 1935. Adults emerged from these pupae in nine to twenty-five days. Neave has collected this species in Lake Winnipeg at a maximum depth of twenty meters (which is the greatest depth occurring in Lake Winnipeg), and in the quiet portions of streams.

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[4] Pupa of *P. maculipennis* (Kol.) differs from *P. indistinctus* (Wlk.) in possessing a dorsal point on abdominal segment III (Sibley, 1926).

*Larva.*—Neave (1933) reared this species for the first time. Length of single larva examined, 13 mm., width, 3 mm. Length of larva as given by Neave, 12 to 16 mm. width 3 to 4 mm. Coloration of head, prothorax and mesothorax follows closely Neave's description and figure. Frontal clypeal suture distinct. Arrangement of setae on frons and labrum is figured for *M. uniophila* Vor. by Vorhies (1909); for *M. blenda* Sib. by Sibley (1926); and for *M. flavicornis* here (Fig. 28). Setae on frons of *M. flavicornis* agrees very closely with those figured for *M. uniophila* Vor. (Vorhies, 1909, figs. 17, 19); differing from *M. blenda* Sib. which has four setae along each lateral margin. Labrum with four setae in center of anterior margin. No tracheal gills on abdominal segment VIII. Last tarsal segment of third leg agrees with Neave's description (1933, p. 25) in being narrow and pointed.

*Pupa.*—Length of 4 pupae as follows: 11 mm., 13 mm., 14.5 mm., 16.5 mm. Length of pupae examined by Neave, 12 to 13 mm. Inner margin of mandible finely serrate, outer margin sinuous. Two setae arise from distinct notch of outer margin (Fig. 29). Labrum with fourteen setae arranged as in figure 30. A corneous tubercle in center of frons; a pair of long setae cephalad and a little laterad to tubercle, and a long seta caudad and laterad to tubercle.

Posterior margin of abdominal segment I with two regularly finely spinulose rows. Near center of segment I a densely spinose line (Fig. 31). Dorsal plates on abdominal segments III to VI. Plates with two to three points, generally two. Second pair of plates on segment V fairly constant in shape, with three points along margin (Fig. 32). Point missing in center of plate of one pupa, and in another pupa one point is small, the other prominent. No gills on segment VIII. Lateral line, gray, extends from segment III to ventral side of segment VIII. Anal appendages finely spinulose. Terminal setae of anal appendages strongly developed and drawn out into fine hairs (Fig. 33).

*Case.*—Larval and pupal cases of fine sand. Length of pupal cases 18 to 22 mm. Pupal case figured (Pl. IV, fig. 45) shows the vertical slit at the closed posterior end and the membrane of silk and sand by which the posterior end of the pupal case is attached to a firm object.

**Anabolia bimaculata** (Walker) (Figs. 34-40.)

Adult

1852. *Limnephilus bimaculata* Walker, Cat. Neurop. Brit. Mus., p. 30.
1861. *Limnophilus bimaculata* Hagen, Syn. Neurop. N. Am., p. 263.
1861. *Limnophilus sordida* Hagen, Syn. Neurop. N. Am., p. 264.
1863. *Limnophilus sordida* McLachlan, Ent. Ann., p. 157.
1864. *Anabolia bimaculata* Hagen, Verh. Zool. Bot. Gesell. Wien, xiv, p. 804.

1877. *Anabolia bimaculata* Provancher, Le Nat. Canad., IX, p. 258. (Petite Fauna Ent. Canada, II, p. 135, 1878.)

1905. *Anabolia bimaculata* Ulmer, Ann. Naturh. Mus. Wien, XX, p. 61, figs. 6–8.

1907. *Anabolia bimaculata* Banks, Cat. Neurop. Ins. U. S., p. 37.

1934. *Anabolia bimaculata* Betten, N. Y. State Mus. Bul. 292, pp. 353, 354, pl. 50, figs. 7, 8, 10.

1935. *Anabolia bimaculata* Milne, Stud. in N. A. Trichop., pp. 43, 49.

Immature stages

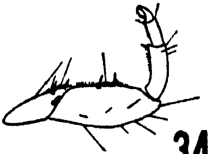
1934. *Anabolia bimaculata* Betten, N. Y. State Mus., Bul. 292, figs. 33e, 36c, 46c, pl. 50, fig. 9, pl. 51, figs. 1–3.

*Habitat.*—Larvae collected from Pine River, a moderately swift stream near the town of Pine River, Minnesota, June 2, 1935; from a small creek flowing into Mille Lacs Lake, June 8, 1935; from the upper end of Rum River, near Mille Lacs Lake, June 8, 1935; from the muddy soft bottomed Little Elk River, near Randall, Minnesota, May 29, 1935; and from Bohall Lake, Itasca Park, Minnesota, June 1, 1935.

*Larva.*—Betten (1934) figured the larval head (Pl. 50, fig. 9), frons (text fig. 33e) and labrum (text fig. 36c); on pl. 51, fig. 1–3 the pupal labrum, mandible and first abdominal tergite is figured.

Length of mature larvae averages 27 mm. Preserved larvae light yellow in color. A comparison of figure 41 with that of Betten's (Pl. 50, fig. 9) will show that the larval heads of Minnesota material are apparently mottled much heavier. Pattern of dark brown mottling on background of straw-yellow quite constant. Cephalic margin of frons with two setae. Anterior margin of labrum with crescentric notch; two light colored spines arise in this notch. Labrum margined with dark brown, clear space near latero-anterior margin from which a light colored fringe of fine hairs arise, just caudad from fringe a light colored, curved spine (Fig. 36). Mandibles prominent, strong, heavily sclerotized, black, with inner fringe of light brown hairs (Fig. 37).

Approximately three-fourths of prothorax covered with prothoracic dorsal plates. Plates straw-yellow, about same as head, mottled with dark brown. Anterior margin shaded darker, posterior margin dark yellow and without dark brown spots. Mesothoracic plates with same ground color of straw-yellow, but less amount of dark brown mottling. Near latero-caudal angle a narrow, relatively long, black line. Posterior margin of plates black. Median plates on metathorax separated, straw-yellow. Second pair of plates, near posterior margin, straw-yellow and triangular. Lateral plates also straw-yellow; each end with dark marks. Large yellowish pentagonal



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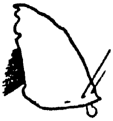

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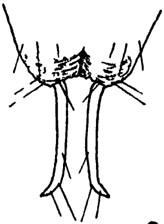

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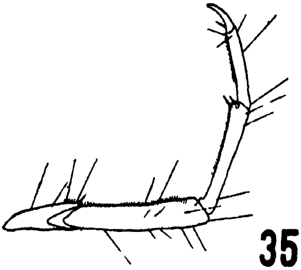

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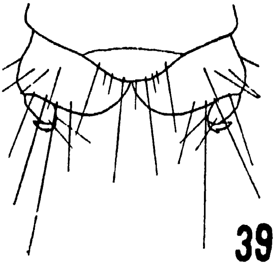

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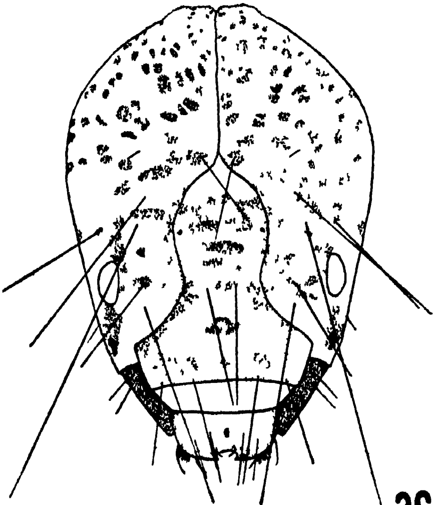

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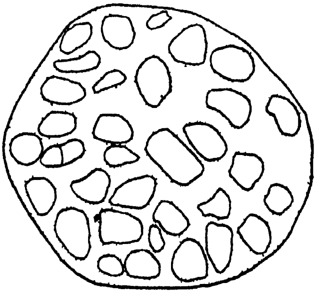

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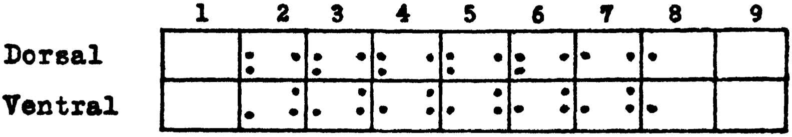
*Anabolia bimaculata* (Walker).—Fig. 34—Fore leg of larva. Fig. 35.—Hind leg of larva. Fig. 36.—Head of larva. Fig. 37.—Mandible of larva. Fig. 38.—Anal segment of pupa. Fig. 39.—Anal segment of larva. Fig. 40.—Sieve of pupal case.

plate in center of prothorax sternum, and near each latero-posterior margin a small darker plate. Sternum of mesothorax with two plates broken into a series of small dark brown marks. Legs light yellow, lightly marked, inner margin of femur, tibia and tarsus with fine comb of yellow spines (Figs. 34 and 35).

Dorsal spacing hump of first abdominal segment colored as surrounding integument. Four groups of black setae, forming a semi-circle, cephalad from dorsal hump. Ventral spacing hump with two groups of dense, closely set setae. Lateral line on segments III to VIII inclusive, of fine, dark brown, closely set hairs. Above lateral line and near anterior portion of each segment a series of small, round, brown dots. Tracheal gills branched.

*Trachael Gill Formula*



| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| **Dorsal** | | ● ●<br>● | ● ●<br>● | ● ●<br>● | ● ●<br>● | ● ●<br>● | ● ● | ● | |
| **Ventral** | | ●<br>● ● | ●<br>● ● | ●<br>● ● | ●<br>● ● | ●<br>● ● | ●<br>● ● | ● | |

Anal segment with semi-circular light yellow dorsal plate, bearing four long and five short black setae. In nine larvae examined the center seta a little off center (Fig. 39).

*Pupa.*—Length, 22–24 mm. Mandibles prominent, dark brown, inner margin straight, as figured by Betten (1934, pl. 51, fig. 2). Labrum, as figured by Betten (1934, pl. 51, fig. 1); group of five long black setae, hooked at tip.

Dorsal tergum of segment I figured by Betten (1934, pl. 51, fig. 3). Dorsal processes do not reach to posterior margin of segment. Dorsal plates on segment III to VIII inclusive, number of points variable, from two to five, majority three or four. In one specimen a long narrow plate occurs on the right side of segment II, bearing five points. Points on second pair of plates of segment V less prominent, number variable, sixteen to twenty-four. Lateral line, of fine dark brown hair, begins on posterior margin of segment V. Anal appendages slender, slightly curved, tapering to a point. Two small setae near tip of anal appendages (Fig. 38). Antennae extend to anterior portion of segment V.

*Case.*—No differences between mature larval and pupal cases. Average length, 37 mm. Cases large and clumsy, composed of sticks and pieces of bark, generally placed horizontally. Pupal case closed with a sieve of tough membrane, the openings variable (fig. 40).

### **Anabolina submonilifer** (Walker)

Adult

1852. *Limnephilus submonilifer* Walker, Cat. Neurop. Brit. Mus., p. 33.
1861. *Limnophilus submonilifer* Hagen, Syn. Neurop. N. Am., p. 260.
1861. *Limnophilus pudicus* Hagen, Syn. Neurop. N. Am., p. 262.
1863. *Limnophilus submonilifer* McLachlan, Ent. Ann., p. 157.
1864. *Goniotaulius pudicus* Hagen, Verh. Zool. Bot. Gesell. Wien, XIV, p. 816.
1873. *Limnophilus pudicus* Hagen, Proc. Boston Soc. Nat. Hist., XV, p. 295.
1877. *Limnophilus pudicus* Provancher, Le Nat. Canad., IX, p. 243. (Petite Fauna Ent. Canada., II, p. 172, 1878.)
1907. *Limnephilus submonilifer* Banks, Cat. Neurop. Ins. U. S., p. 37.
1908. *Limnephilus submonilifer* Banks, Trans. Amer. Ent. Soc., XXXIV, pl. 18, figs. 12, 16.
1908. *Limnephilus submonilifer* Banks, Psyche, XV, p. 63.
1909. *Limnephilus submonilifer* Vorhies, Trans. Wis. Acad. Sci., XVI, pp. 666, 667; pl. 54, fig. 18; pl. 55, figs. 1, 2.
1915. *Anabolina submonilifer* Döhler, Deut. Ent. Zeitschr., p. 407, figs. 15, 16.
1926. *Limnophilus (Rheophylax) submonilifer* Sibley, Bul. Lloyd Library, no. 27, p. 107.
1934. *Rheophylax submonilifer* Betten, N. Y. State Mus. Bul., no. 292, pp. 340, 341, fig. 6b; pl. 48, fig. 1, 2.
1935. *Anabolina submonilifer* Milne, Stud. in N. A. Trichop., pp. 41, 49.

Immature stages

1909. *Limnephilus submonilifer* Vorhies, Trans. Wis. Acad. Sci., XVI, pp. 667, 668; pl. 52, fig. 4; pl. 54, figs. 19–21.
1921. *Limnophilus submonilifer* Lloyd, Bul. Lloyd Library, no. 21, pp. 51–53, figs. 67–70.

This species has previously been reared by Vorhies (1909) and by Lloyd (1921). There is no doubt that the temporary pond species discussed by Elkins (1936) is also this species. Vorhies (1909) and Lloyd (1921) described and figured the larval stage. Minnesota material agrees very well with these descriptions. Vorhies described the pupa and made drawings of the mandible, labrum and anal appendages (Pl. 54, figs. 19–21) from a single specimen. Minnesota pupae do not agree in all details with Vorhies'. Vorhies gave the pupal length as nine millimeters, Minnesota pupae vary from twelve to fifteen millimeters. In Vorhies' specimen the antennae extended to segment IX; in six

Minnesota pupae antennae extended to anterior margin of segment VII. Vorhies reported dorsal plates present on segments IV to VII inclusive; in all Minnesota pupae examined dorsal plates present on segment III, this plate bearing two points. Number of points on second pair of plates on segment V variable. Vorhies reported six to seven points on these plates; in material examined here the number varied from eight to sixteen, the number not always constant on the same individual. Lateral line, in all Minnesota pupae examined, composed of fine, thickly set, dark brown hairs, beginning on the posterior portion of segment V, not VI as Vorhies found.

*Habitat.*—Larvae were easily obtained during April, 1935, in temporary ponds in Dynamite Woods, Ramsey County, Minnesota. Early in April the larvae were of various sizes, many of them small. Taken to the laboratory the larvae pupated May 1, and the first adult emerged May 15. During the spring of 1936 larvae were very difficult to obtain from these same ponds. Larval cases 10 millimeters long were obtained from a temporary roadside pond, fifteen inches long and six inches deep, near Sartell, Minn., May 2, 1936.

*Case.*—The photograph of the larval case by Elkins (1936, pl. I, fig. 6) is typical of the case found in collections made from widely scattered temporary ponds. Pupal cases somewhat shorter than length of larval cases given by Vorhies and Lloyd (20–30 mm.); a large series varied from fourteen to twenty millimeters. In majority of pupal cases examined, the anterior end is margined with a few grains of sand which may even extend over the sieve closing the opening. Generally the posterior sieve is loosely covered by grains of sand. Anterior and posterior sieve perforated with many small circular holes, irregularly arranged.

**Hesperophylax designatus** (Walker)

1852. *Limnephilus designata* Walker, Br. Mus. Cat., Neur., p. 24.

This species has been reared a number of times: excellent descriptions and figures by Marshall and Vorhies (1905); Vorhies (1905, 1909); Lloyd (1921) and Elkins (1936). Notes on the abundance of this species is added here. Immature stages are abundant in the stream at the Isaac Walton Bass Pond, Hennepin County, Minnesota. Here it is not uncommon to find clusters of a dozen or more pupal cases under a favorable stone.

One pupal case was taken from a log which was six inches above the surface of the water. The pupa was alive and later emerged in the laboratory. In a small, spring-fed, narrow creek, with sand and gravel bed, flowing into Nine Mile Creek, Hennepin County, Minnesota, large numbers of pupal cases of this species were found on May 4, 1935. Pupal cases were found adhering to the under sides of stones or pieces of wood. On a submerged piece of wood, in four square inches, twenty-seven live pupal cases were removed.

**Agraylea multipunctata** Curtis

1834. *Agraylea multipunctata* Curtis, Philos. Mag., p. 217.

This species has been reared many times and excellent descriptions and figures of immature stages are available. The most outstanding work on this species is by Morton (1886), Silfvenius (1904), Ulmer (1909), and figures by Betten (1934).

On April 30, 1935, a large number of adults of this species were observed flying near a cement dam at the Isaac Walton Bass Pond, Hennepin County, Minnesota. Large numbers of these adults were running about very quickly on the sunny side of this cement dam. A few pairs were taken in coitu. Adults were observed emerging from the surface of the water. Large numbers of pupal cases were found attached to bark, stones, debris and on the cement dam. On one piece of bark, one inch wide, and three inches long, eighty-two pupal cases were counted.

Morton (1886) and others reported the pupal cases are fastened flat to a support, with the four corners attached by a " stalked fan-like patella ". In all Minnesota material examined the pupal case is attached by the anterior and posterior corners of one margin only, by a stalked fan-shaped membrane of tough silk.

These light brown pupal cases, which remind one of a miniature leech egg-packet, vary considerably in size. Ulmer (1909) gave the length, 5 to 8 mm., and the breadth 1.3 to 2.2 mm. Minnesota material agrees very well with these dimensions, the largest being 7 mm. long and 2 mm. wide.

The pupa cuts a clean, neat horizontal opening between the two layers of the case, swims to the surface and transforms to an adult.

On May 6, 1935, several pairs of males and females were collected in coitu and taken to the laboratory. Soon after being placed in a pint jar partly filled with water and a few blades of grass, a female descended into the water and swam about nervously. Using only her legs she swam very rapidly, a film of air completely enveloping her. Female No. 1 descended into the water and soon found a stem of grass and settled down to egg-laying. She remained quiet for six and one-half minutes, then moved ahead, and began egg-laying again. She appeared quite nervous, continually moving the abdomen, placing one egg, and then moving a short distance. After thirty-nine minutes she returned to the surface, rested on the surface film for ten minutes, then descended again and remained under water laying eggs for another eighteen minutes. Female No. 2 remained submerged, laying eggs, for one hour and eight minutes consecutively. Next morning both females were dead, lying in the bottom of the jar.

Eggs rather flat, elliptical, not placed closely together. Ulmer (1909) observed that up to 300 eggs may be laid, the egg masses 3.3 to 6 mm. long, 1.7 to 3 mm. wide, and that when laid closely together the eggs may be pressed into a hexagonal shape. Preserved eggs colored light tan.

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## EXPLANATION OF PLATE IV

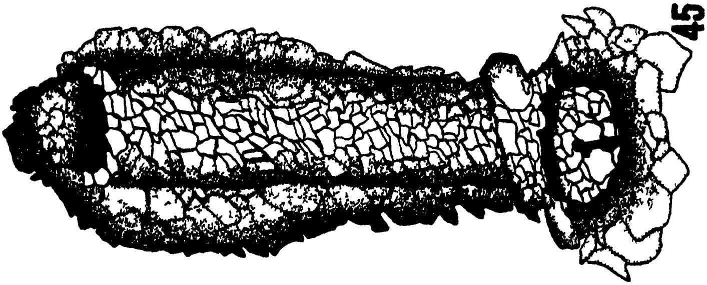
Fig. 41.—Pupal case of *Platycentropus indistinctus* (Walker)

Fig. 42.—Pupal case of *Anabolina canadensis* (Banks)

Fig. 43.—Pupal case of *Brachycentrus fuliginosus* (Walker)

Fig. 44.—Larval case of *Mystacides longicornis canadensis* (Banks)

Fig. 45.—Pupal case of *Molanna (Molanna) flavicornis* Banks



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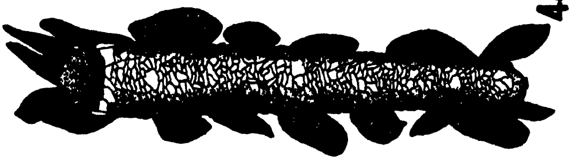

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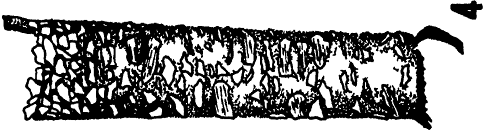

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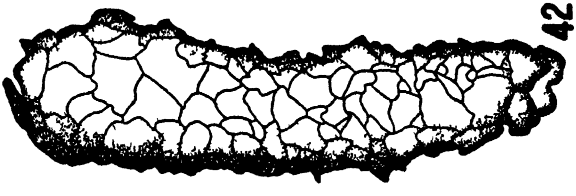

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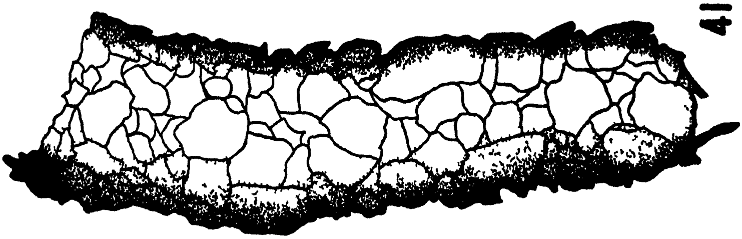

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DENNING—MINNESOTA TRICHOPTERA

# A REVISION OF THE GENUS MEGACHILE IN THE NEARCTIC REGION [1]

## PART VI [2]

## TAXONOMY OF SUBGENERA ARGYROPILE, LEPTORACHIS, PSEUDOCENTRON, ACENTRON AND MELANOSARUS

**(Hymenoptera: Megachilidae)**

BY THEODORE B. MITCHELL

(Plates V-VI)

The five subgenera included in this paper, together with the subgenus *Phaenosarus* (included in Part IV) show some indications of relationship. First, in distribution they occupy much the same range, being chiefly neotropical, those species which occur in the nearctic region being much in the minority. *Argyropile* and *Phaenosarus* are the only exceptions to this, most of the known species being nearctic.

One structural feature possessed by all of these groups to at least some degree is the reduction of the scopa on the sixth sternum in the female, together with the prolongation of the apex of the plate into a bare apical lip. In *Argyropile* and *Phaenosarus* the scopa is thin toward the apex of the plate, but it is otherwise fairly well covered with scopal hairs. In all the remaining groups it is reduced to a mere marginal fringe with the center entirely bare. In *Leptorachis* the apex of this plate is not produced, in contrast with the other groups. This bare apical lip is especially conspicuous in the genotype of *Argyropile*

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[2] Parts I, II, III, IV, and V. Trans. Am. Ent. Soc., LIX, pp. 295-361, (1934); LXI, pp. 1-44, (1935); LXI, pp. 155-205, (1935); LXII, pp. 117-166, (1936); LXII, pp. 323-382, (1937).

(*parallela*), being sharply reflexed dorsally. In certain of the other species at present included in that group, as well as in *Phaenosarus*, it is considerably thickened.

In the males there is a tendency toward the reduction of the mid-tibial spur. This is present in *Argyropile, Phaenosarus* and *Leptorachis*, although somewhat reduced in size in the latter; but in *Melanosarus, Pseudocentron* and *Acentron* this spur is entirely lacking. In *Pseudocentron* the apical inner angle of the tibia is produced into a spur-like protuberance which occupies the usual position of the spur in other groups.

*Argyropile* and *Leptorachis* are the more generalized groups in this complex, the other groups being quite specialized structurally, the males having conspicuously dilated and colored anterior tarsi and many other similar characters. The front tarsi of these two generalized groups of species are simple in all of the forms recognized at present, and the hidden sterna in the males are relatively simple, in marked contrast with the complex sternal plates of the more specialized groups.

## Subgenus **ARGYROPILE** Mitchell

*Argyropile* Mitchell, Trans. Am. Ent. Soc., LIX, p. 302. 1934.

There is rather strong evidence now that *Argyropile* is related to *Phaenosarus* (see part IV). *M. flavihirsuta* Mitchell,[3] described from Mexico, is the significant form. Until very recently this was known only in the male sex, and while this sex resembles the species of *Phaenosarus* in having the carina of the sixth tergum entire and in other respects is very similar, in all its other characters it resembles *Argyropile,* especially in those of the genital armature and hidden abdominal sterna. The similarity of the sixth tergum to that in *Phaenosarus* was considered to be more apparent than real. The female of *flavihirsuta* however has come to light quite recently in a collection received from the British Museum, and it bears a very close resemblance to the females of *Phaenosarus*. The dentition of the mandibles represents an almost intermediate condition between *parallela* (*Argyropile*) and *fortis* (*Phaenosarus*), and the apex of the abdomen also shows similarities to both of these species.

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[3] Trans. Am. Ent. Soc., LVI, p. 225. 1930.

The males of two of the species included in *Argyropile* are yet to be recognized, and with their discovery will come possibly more significant evidence concerning the interrelationships of these species.

Tongue: Second joint of labial palpus slightly longer than the first; maxillary palpi not pubescent, the third joint more slender, but slightly longer than either of the other joints.

*Female.*—Mandibles 4-dentate, a relatively long cutting edge between the third and fourth teeth, a small and often obscure one between the second and third; basal joint of flagellum usually slightly longer than either the pedicel or the second joint; mid and hind metatarsi nearly equalling their tibiae in width and only slightly shorter; abdomen cordate, the more apical segments usually quite deeply depressed across the apical margins; sixth tergum more or less triangular, usually covered in large part by appressed pale tomentum, and with but a slight amount of erect pubescence toward the base, usually nearly straight as seen in profile; sixth sternum either bare or thinly pubescent toward the apex, but with a subapical dense fringe of short hairs beyond which there is a short bare lip, this usually flexed upward, sometimes considerably thickened.

*Male.*—Mandibles usually 4-dentate, with a slender acute subbasal inferior projection; basal joint of flagellum slightly longer than the pedicel, but considerably shorter than the second joint, the apical one neither dilated nor flattened; cheeks simple below; front coxae with spines of moderate length, rather densely pubescent, and lacking any red bristles; front tarsi simple; mid tibia with the usual apical spur; sixth tergum with a relatively narrow but conspicuous carina which is usually deeply emarginate medially, the apical margin of the segment with conspicuous median and lateral teeth, the median ones nearer the lateral ones than to each other; seventh tergum relatively conspicuous.

Male sternites: Fourth sternum exposed; fifth sternum not highly modified, the medasternal area but slightly differentiated from the presternal and poststernal areas, and sparsely covered with fine setae; sixth sternum much shorter than the fifth, not highly modified, the medasternal areas separated to some degree, recognizable chiefly by the rather large and numerous setae, the poststernal area not distinctly lobelike.

Genital armature: Stipites slightly dilated apically, non-pubescent, the sagittae equalling or surpassing them in length.

GENOTYPE: *Megachile parallela* Smith. [Orthotype.]

## *Key to Species of Argyropile*

### Females

1. Clypeal margin slightly protuberant, polished and impunctate medially and with a very small median tubercle ............................2
   Clypeal margin without a definite median polished area, and the median tubercle either absent or reduced to a mere trace ..................5
2. Sixth abdominal tergum definitely concave in profile, entirely covered with closely appressed pale tomentum, without basal erect hairs.
   *townsendiana* Cockerell
   Sixth tergum quite or very nearly straight in profile, with erect hairs evident toward the sides basally ..................................3
3. Scopa on sixth sternum black; ..........*parallela* var. *reta* new variety
   Scopa entirely pale; fasciae whitish ..................................4
4. Lateral ocelli slightly nearer edge of vertex than to eyes.
   *parallela* var. *tulariana* new variety
   Lateral ocelli equidistant from eyes and edge of vertex ..*parallela* Smith
5. Scopa black on sixth sternum; clypeal margin with a very minute tubercle ....................................*sabinensis* Mitchell
   Scopa entirely pale; clypeal margin without any trace of a tubercle.
   *nebraskana* Mitchell

### Males

1. Larger (13 mm., 5 mm. broad); carina of sixth tergum broader, the dorsal surface before the emargination broadly impressed.
   *parallela* Smith
   Much smaller (10 mm., 3 mm. broad); carina of sixth tergum narrowed apically, slightly curved ventrad, the emargination small, upper surface not impressed .............................*townsendiana* Cockerell

**Megachile (Argyropile) parallela** Smith (Pls. V and VI.)

*Megachile parallela* Smith, Cat. Hym. Brit. Mus., II, p. 191. 1853. Cockerell, Trans. Am. Ent. Soc., XXXI, p. 337, 1905. Cockerell, Ann Mag. Nat. Hist., (8), II, p. 536, 1913. Mitchell, Trans. Am. Ent. Soc., LIV, p. 333, 1929. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

*Megachile facunda* Cresson, Trans. Am. Ent. Soc., IV, p. 266, 1872. Cresson, Mem. Am. Ent. Soc., I, p. 118, 1916.

*Megachile pruina* Cresson, Trans. Am. Ent. Soc., IV, p. 268, 1872. Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 11, 1900. Cockerell, Can. Ent., XXXV, p. 215, 1903. Friese, Das. Tierr., Lfg. 28, Apidae I, p. 244, 1911. Mitchell, Psyche, XXXIII, p. 163, 1926.

*Megachile sexdentata* Robertson, Trans. Am. Ent. Soc., XXII, p. 125, 1895. Robertson, Trans. Ac. St. Louis, VII, (no. 14), p. 351, 1897. Robertson, Can. Ent., XXXIV, p. 49, 1902. Robertson, Trans. Am. Ent. Soc., XXXIX, p. 172, 1903. Cockerell, Ent. News, XV, p. 171, 1904. Cockerell, Univ. Colo. Stud., IV, (no. 4), p. 254, 1907. Cockerell, Univ. Colo. Stud., VII, p. 128, 1910. Friese, Das Tierr., Lfg. 28, Apidae I, p. 246, 1911.

This species varies considerably as to color of pubescence, most of the western material showing very little dark hair on the vertex and none on the thorax, and the dark hair of the discs of the abdominal segments is very inconspicuous in some cases. In specimens from the east the vertex, mesonotum, and second to fifth abdominal segments usually have rather conspicuous black pubescence.

*Female.*—Size: Length 13–14 mm.; breadth of abdomen 4.5–5 mm.; anterior wing 9–10 mm.

Structure: Face broader than long; eyes slightly convergent below; clypeal margin with a median shining slightly produced area, in the center of which is a small denticle; mandible 4-dentate, a rather long cutting edge between the two inner teeth, a short one between the two middle teeth; basal joint of flagellum slightly longer than the pedicel; lateral ocelli subequally distant from eyes and edge of vertex; vertex flat; cheeks subequal in width to eyes; mid metatarsi about as broad as their tibiae but somewhat shorter, the apical angles of the first three joints considerably prolonged; hind metatarsi subequal to their tibiae in both length and breadth; abdomen cordate, hind margins of the segments slightly depressed medially, distinctly so laterally; sixth tergum nearly triangular in dorsal aspect, the tip truncate, very nearly straight in profile with no visible erect hair; sixth sternum with sparse pubescence toward the apex, the tip beyond a short subapical fringe bare and sharply upturned, fitting against the truncation of the tergum.

Puncturation: Fine and close on face and cheeks; somewhat more coarse on other parts of head, rather close on vertex, rather sparse on clypeus; fine and close on scutellum, on pleura above, and on mesonotum except medially where the punctures are well separated, the mesonotum and scutellum tessellate and dull; fine and close on abdomen basally, becoming increasingly distinct and deep but rather close to the fifth tergum, very fine and close on the sixth.

Color: Black; antennae dark ferruginous beneath; tegulae dark ferruginous; wings subhyaline, slightly darker apically, the nervures ferruginous to piceous; spurs yellow.

Pubescence: White on head, thorax and abdomen, more or less intermixed with fuscous on vertex and mesonotum, blackish on discs of second to fifth terga, more whitish on the second medially, the sixth covered with fine pale tomentum over apical half, first to fifth terga with entire white apical fasciae, that on the first very narrow; scopa entirely white.

*Male.*—Size: Length 12–13 mm.; breadth of abdomen 3.5–5 mm.; anterior wing 8–9.5 mm.

Structure: Face broader than long; eyes slightly convergent below; clypeal margin slightly produced medially, this portion shining, slightly incurved, and with a minute median tubercle; mandible 4-dentate, the second tooth somewhat rounded, the inferior projection slender, subbasal and acute; basal joint of flagellum distinctly longer than the pedicel but shorter than the second joint, the apical one neither dilated nor flattened; lateral ocelli slightly nearer eyes than to edge of vertex; vertex flattened; cheeks slightly broader than eyes; front coxae with spines of moderate length, but these obscured by the dense pubescence; front tarsi simple, neither dilated not flattened; mid and hind metatarsi about two and a half times longer than broad; abdomen broad and rather flat, parallel-sided, the more apical segments deeply depressed across the apical margins, the margin of the disc of the fifth tergum much overhanging the depressed apical border; carina of sixth tergum rather narrow, more or less rounded, but with the tip deeply and roundly emarginate, very slightly crenulate on each side, the apical margin of the tergum with conspicuous teeth, the median ones blunt, more distant from each other than from the more acute lateral teeth; seventh tergum evident, somewhat triangular, but the tip narrowly truncate and slightly emarginate.

Sternites: Fifth sternum but slightly modified, the medasternal area restricted as indicated by the sparse short apically dilated setae located near the center of the plate, the poststernal strip obscure, its apical margin slightly incurved on each side of middle; lateral portions of sixth presternite somewhat broader than long, each with a small apical patch of long fine pubescence, the medasternal areas occupying most of the median half of the plate, slightly separated medially, uniformly beset with sparse, rather robust and apically flexed and dilated setae, the poststernal lobe short; broad, outcurved medially, not at all angulate.

Genital armature: Stipites narrowed above base, slightly sinuate to the tip, but not at all dilated; sagittae about equally as robust as the stipites and slightly exceeding them in length; volsellae triangularly acute.

Puncturation: Rather close and fine on the shining cheeks and vertex, more distinctly separated on vertex laterally; fine and close on thorax, slightly more sparse in center of mesonotum, this and the scutellum tessellate and dull (punctures nearly obliterated in center of mesonotum in some specimens); very fine and close on abdomen basally, becoming increasingly distinct and deep, though close, to the fifth tergum, the sixth more rugoso-punctate.

Color: Black; antennae dark reddish or piceous beneath; tegulae more or less dark ferruginous, but tending to yellowish anteriorly; wings subhyaline, faintly clouded apically, the nervures ferruginous; legs piceous, tending to ferruginous in some apecimens; spurs yellow.

Pubescence: Pale ochraceous above, becoming white beneath, dense on face and clypeus, cheeks below, and on thorax laterally and beneath, without dark admixture on head, thorax, or on abdomen basally, the more apical segments with dark pubescence on discs apically, just before the fasciae; second to fifth terga with entire pale ochraceous apical fasciae, the fourth and fifth with considerable pale tomentum basally, and the sixth largely covered with pale tomentum so as to hide the surface; front tarsi with thin but rather definite posterior white hair fringes.

*Type.*—Male; Georgia, [British Museum, 1879-22].

*Range.*—Throughout the Western United States and Southern Canada, extending southeastward to North Carolina and Florida, flying throughout the season. Definite records are as follows:

Arizona: 1♂, no locality record. 1♂, Phoenix, Aug. 3, 1917, (Wheeler). 2♂, 2♀, Tempe, July 31, 1917, (Wheeler). 1♀, Santa Rita Mts., July 24. Identified also from Palmerlee and S. Catalina Mts.

British Columbia: 1♂, Kamloops, Aug. 1904. Identified also from Medicine Hat, Summerland, and Thompson River.

California: 2♂, no data. 1♂, Bolinas, Aug. 18, 1936, (G. E. Bohart). 1♀, Florence L., Fresno Co., July 1930, (Michener). 3♂, Hospital Rock, Sequoia Nat. Park, Sep. 4, 1933, (Michener; on milkweed). 1♂, Mt. Diablo, May 24, 1936, (R. M. Bohart). 1♀, Riverside, July 11, 1933. 1♂, 1♀, Riverside, June 8, Sep. 4 and 26, (Timberlake; on *Heterotheca grandiflora* and *Encelia farinosa*). 1♂, 1♀, Santa Catalina Island. 1♀, Santa Monica, June 30, 1935, (E. G. Linsley). 1♀, Westwood Hills, Los Angeles Co., July 27, 1935, (E. G. Linsley). Identified also from Auburn, Los Angeles and Stanford University.

Colorado: 6♂, 8♀, no data, 7-12, 1919. 2♀, Boulder, Aug. 11, 1911, (S. A. Rohwer; on *Helianthus*). 1♀, Boulder, Aug. 1♂, Boulder, July 29, 1922. 1♂, 1♀, Boulder, July 9, 1924 and July 25, 1925 (L. O. Jackson; ♀ on *Helianthus petiolaris*). 18♂, 38♀, Boulder County, June 9 to Sept. 18 (Custer and Hicks). 4♀, 21♂, Duck Creek, Aug. 4, 1933 (Helen James). 4♀, Elbert, Aug. 11, (Figgins). 1♂, 1♀, Hubbard Ranch, Elbert, June 9 and July 29 (Figgins; on *Gilia*). 1♂, LaJunta, Aug. 12, 1920. 2♂, 1♀, Poudre Fks, Aug. 25, 1898. 1♀, Wray, Aug. 17-19, 1919. 2♂, Zimmerman, Aug. 26, 1935 (Figgins). Identified also from Cheyenne Wells (July 27, 1933, Rodeck and James), Clear Creek, Denver, Eldorado Springs, Flagler (July 25, 1933, Rodeck and James), Fruita, Glenwood Springs, Granada (July 31, 1933, Rodeck and James), Grand Junction, Logan County, Lolita (Aug. 8, 1933, Rodeck and James), Meeker, Montrose, Palisades, Pueblo, Sterling, Tobe (Aug. 4, 1933, Rodeck and James), and Walker Hill, Crowley County (Aug. 8, 1933, Rodeck and James).

FLORIDA: 1♀, Miami, June 5, 1927. 1♀, Miami Beach, Aug. 17, 1927; (both S. Graenicher).

IDAHO: 1♀, Twin Falls, Aug. 3, 1934, (H. A. Scullen). Identified also from Moscow.

MEXICO: 1♀, Guadalajara, Aug. 23, 1903, (McClendon).

MONTANA: 5♂, 65♀, no data. Identified from Helena, Jefferson County, Pondera County.

NEBRASKA: 1♀, Crete, (F. Rauterberg). 3♂, 2♀, Glen, Sioux County, Aug. 13–17, 1906, (L. Bruner). 1♀, Halsey, Aug. 22, 1912, (J. T. Zimmer). 3♂, Mitchell, July and Aug., 5 and 10. (Patridge and Gates). 1♀, Mitchell, July 17, 1916, (C. E. Mickel; on *Melilotus alba*). 1♀, Mitchell, July 17, 1916, (C. E. Mickel; on *Melilotus alba*). 1♀, Monroe Canyon, Sioux County, July 1, 1911, (R. W. Dawson, on *Helianthus petiolaris*). 2♀, War Bonnet Canyon, Sioux County, July 23, 1901, (M. Cary; on *Helianthus*). 1♀, West Point, Sept. 9, 1912, (J. C. Crawford). Identified also from Bridgeport, Broken Bow, Carns, Crawford, Gering, Haigler, Harrison, Imperial, Lincoln, McCook, Sidney, South Bend, and Union.

NEVADA: 1♂, no data.

NEW MEXICO: 2♂, Alamogorda, April 22 and 29, 1902. 1♂, Albuquerque, Sept. 1–3, 1935 (Michener). 1♂, Highrolls, June 11, 1902. Identified also from Raton (Aug. 5, 1933; Rodeck and James) and Little Tesuque Canyon, vic. Santa Fe., 9200 ft., July 27–Aug. 10, 1932 [Wards. Nat. Sc. Est.].

NORTH CAROLINA: 1♀, Raleigh, Sept. 13, 1929, (Mitchell; on *Helianthus atrorubens*).

OREGON: 1♀, Corvallis, Aug. 29.

SOUTH DAKOTA: 1♀, Pierre. 1♀, Rapid City. 1♂, 2♀, Volga.

TEXAS: 4♂, 12♀, no data (Belfrage). 1♀, Austin. Oct. 9. 4♂, 9♀, Austin, April 21 to May 12, 1933. 3♂, 14♀, Bexar County, April to October, (Parks). 1♂, Devils River, May 7, 1907, (F. C. Pratt; on *Gaillardia pulchella*). 2♂, 2♀, Fedor, Lee County, April 26, and May 1, 1909. 2♀, Keerville, April 11, 1907, (F. C. Pratt, and P. Durham). 2♂, Willis, June 11, 1903, (Bridwell). Identified also from Arlington, Anhalt, Comstock, Cotulla, Dallas, New Braunfels, Newcrest, and Sabinal.

UTAH: 1♀, Bothwell July 29, 1929 (G. F. Knowlton). 1♂, 1♀, Huntsville, July 26, 1920. 3♀, Hyrum, Sept. 13, 1935 (J. C. Sorenson). 1♀, Naples, Sept. 7, 1932, (Knowlton and Hans). 2♀, Salt Lake City, July 28, 1920. Identified also from Eureka and Ogden.

WASHINGTON: 1♂, Walla Walla, June 1936, (G. E. Bohart). 1♀, Wawawai, (C. V. Piper). Identified also from Yakima City.

WYOMING: 1♀, Casper, Aug. 4, 1926, (Ruth K. Hicks). Identified also from Douglas and Green River.

Specimens of *parallela* have been identified from the following additional localities: Alabama—Selma: Alberta—Lethbridge; Illinois; Indiana—South

McAlister; Kansas—Baldwin, Blue Rapids, Dickinson, Ellis, Pratt County, Riley County and Rooks; North Dakota—Dickinson, Medora, Mott, Schafer, Williston and Washburn; Oklahoma—Ardmore; and Saskatchewan —Swift Current.

*Flower records.*—This is a generalized insect in its flower visiting habits, visiting a wide range of flowers, including numerous species of Composites as well as species of various other genera such as *Ceanothus, Hypericum, Medicago* and *Verbena.*

**Megachile (Argyropile) parallela** var. **rita** new variety

*Female.*—Similar to typical *parallela* structurally, so far as can be determined, differing chiefly in having the hairs of the scopa on the sixth sternum dark or blackish and in having more dark pubescence on the vertex, mesonotum and discs of the abdominal segments. The type has rather deep ochraceous pubescence dorsally, while the paratypes, from widely scattered parts of the country, are more greyish or whitish pubescent, as in typical *parallela.* It may represent an extreme in color variation among individuals rather than a true racial variety.

*Type.*—Female; Mt. Santiago, California, Sep. 19, 1926, (P. H. Timberlake; on *Ericameria parishii*), [U.S.N.M., no. 44251].

*Paratypes.*—2 ♀, Texas. 1 ♀, Nowlin County, South Dakota. 1 ♂, 1 ♀, Georgia. 1 ♀, Cisco, Eastland County, Texas, Sep. 21-22, 1912, 1450-1550 ft., (R. & H.); [all A.N.S.P]. 1 ♀, Grand Junction, Colorado, Aug. 3, 1920, (F. 4758), [Am. Mus. Nat. Hist.].

**Megachile (Argyropile) parallela** var. **tulariana** new variety

*Female.*—This differs slightly from typical *parallela* structurally in that the lateral ocelli are nearer the edge of the vertex than to the eyes, and the sixth sternum projects considerably beyond the tip of the sixth tergum. The pubescence is whitish on the head and thorax, but largely blackish on the vertex, and with some evidences of dark pubescence in center of mesonotum, but this largely denuded; more ochraceous behind wings and across scutellum; ochraceous on first and second abdominal terga, the third to the fifth with short black pubescence on the discs, the sixth with appressed ochraceous tomentum apically, with erect dark hairs across the base; second to fifth terga with entire ochraceous apical fasciae; scopa white, but more orange toward the tip of the sixth sternum.

*Type.*—Female; Lemon Cove, Tulare Co., California, July 9-11, 1907, 500 ft., (J. C. Bradley), [Cornell University, no. 1111].

**Megachile (Argyropile) townsendiana** Cockerell (Pls. V and VI.)

*Megachile townsendiana* Cockerell, Ann. Mag. Nat. Hist., (7), I, p. 129, 1898. Cockerell, Denison Univ. Bull., XI, p. 65, 1898. Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 12, 1900. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

*Megachile bishoppi* Cockerell, Ann. Mag. Nat. Hist., (8), XV, p. 535, 1915.

*Megachile bishoppi* Cockerell is apparently an individual variant of *townsendiana*. According to the description it shows the following differences from the typical form: "Hair of face creamy (instead of pure white); thorax above very hairy, with only a very indistinct band in scutello-mesothoracic suture; keel of sixth abdominal segment smaller, less deeply emarginate, with the lobes on each side of the emargination much smaller".

*Female*.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 7 mm.

Structure: Face broader than long; eyes very slightly convergent below; clypeal margin with a rather narrow, slightly produced, median shining area, in the center of which is a minute tubercle; mandible 4-dentate, a rather long cutting edge between the two inner teeth, that between the two middle teeth small and inconspicuous; basal joint of flagellum longer than the pedicel, subequal to the second joint; lateral ocelli subequally distant from eyes and edge of vertex; vertex flat; cheeks subequal in width to eyes; mid and hind metatarsi definitely shorter than their tibiae but subequal to them in width, apical angles of the mid tarsal joints considerably produced; abdomen cordate, the segments but slightly depressed on the apical margins medially, more deeply so laterally, the third tergum rather deeply grooved basally, the sixth rather short and broad, rounded or subtruncate apically, in profile concave toward the apex, with no erect hairs visible.

Puncturation: Fine and close on cheeks, vertex, and over most of thorax, more distinctly separated in center of mesonotum and on vertex medially, becoming rather coarse and distinct on pleura below, quite coarse and deep on clypeus, closer below; minute and close on abdomen basally, becoming increasingly distinct, deep, and more sparse to the fifth tergum, minute and densely crowded on the sixth.

Color: Black; antennae beneath more piceous; tegulae yellowish; wings subhyaline, faintly clouded apically, the nervures brownish to fuscous; spurs yellow.

Pubescence: Entirely white on head, thorax, and the first segment of the abdomen, the discs of the second to the fifth segments with short inconspicuous dark pubescence, the sixth entirely covered with extremely fine silvery tomentum; first to fifth terga with entire white apical fasciae, the scutello-mesothoracic suture white-fasciate, and the mesonotum with a pair of short anterior oblique lines of white tomentum; pubescence of legs entirely white; scopa entirely white.

*Male.*—Size: Length 10 mm.; breadth of abdomen 3 mm.; anterior wing 7 mm.

Structure: Face broader than long; eyes slightly convergent below; clypeal margin slightly produced medially, this portion shining, slightly incurved, and with a minute median denticle; mandible 4-dentate, the second tooth slightly rounded, the inferior projection slender, acute, subbasal; basal joint of flagellum slightly longer than pedicel, the second joint about twice the length of the first, the apical one neither dilated not flattened; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks subequal in width to eyes; front coxae with spines of moderate length, thinly pubescent anteriorly; front tarsi slender and simple; mid and hind metatarsi rather short and slender; abdomen flattened, parallel-sided, the more apical terga deeply depressed across the apical margins, the disc of the fifth overhanging slightly the depressed apical border; carina of sixth tergum rather narrow, tapering apically, but the tip with a small median emargination, narrowly rounded on each side of this, the carina slightly downcurved as seen in profile, apical margin of the tergum with conspicuous acute teeth, the median ones nearer the lateral teeth than to each other.

Sternites: Pre- and medasternites of fifth sternum closely united, but the medasternite quite clearly defined by the occurrence of straight, apically dilated setae, these becoming more sparse apically and laterally, the medasternal area broad, the presternite with some very fine pubescence on each side apically, the poststernal strip obscure, but with a straight apical margin; lateral portions of sixth sternum about as broad as long, with some very fine pubescence apically, the medasternal areas quite widely separated medially, more or less ovoid in outline, carinate laterally, well covered with robust straight, apically dilated and flattened setae, the poststernal lobe obscure, apparently very broad and short, outcurved apically.

Genital armature: Stipites gradually narrowed above base, hardly sinuate, but dilated and strongly compressed toward tip, apex obliquely truncate, non-pubescent; sagittae robust, considerably exceeding the stipites, thickened apically; volsellae triangularly acute.

Puncturation: Fine and close on cheeks and pleura; more distinctly separated and slightly more coarse on vertex, mesonotum and scutellum, becoming relatively sparse in center of mesonotum; fine and close on basal segments of abdomen, but becoming increasingly distinct and deep, although quite close, to the fifth tergum, the sixth more rugosopunctate at least basally, the tip of the carina shining and with sparse punctures.

Color: Black; antennae more piceous; tegulae yellowish-ferruginous; wings subhyaline, faintly clouded apically, the nervures yellowish or brownish; legs dark; spurs yellow.

Pubescence: White on head, thorax, and on the first, second and sixth abdominal segments, the discs of the third to the fifth with dark pubescence, the first to the fourth with entire white apical fasciae, the fifth and sixth with a considerable amount of whitish tomentum basally, and the fourth with a narrow basal line of whitish tomentum; legs entirely pale pubescent, dense on posterior faces of front trochanters and femora, the tarsi without conspicuous hair fringes.

*Type.*—Male; Las Cruces, New Mexico (on *Chrysopsis villosa*), [Cockerell].

*Range.*—Arizona and Colorado, east through Texas and along the Gulf to Florida, May to September. Definite records are as follows:

Colorado: 1♀, Sandhills north of Roggen, Sept. 12, 1934, (H. G. Rodeck).

Florida: 2♂, 6♀, Miami Beach, July 27 to Sept. 27, 1927 (Graenicher). 3♂, Miami Beach, Aug. 11, 1935 (Mitchell). Also identified from Fort Lauderdale (May).

Lower California: 1♀, no data.

New Mexico: 2♀, Albuquerque, June 27, 1931, 5000 ft., (H. A. Scullen). 1♂, Las Cruces, July 28, 1♂, Rincon, July 6, (Cockerell; on *Actinella*). Also identified from Deming.

Texas: 1♀, Bexar County, Oct. 2, 1932, (Parks), 1♀, Fedor, Lee County, June 7, 1909. 1♂, Finlay, Hudspeth County, Sept. 4, 1927, (J. C. Bradley). 1♂, Galveston, June 1900. 1♀, Midland, Sept. 5, 1927, (J. C. Bradley). 2♂, 6♀, Pecos, Aug. 28, 1935, (E. M. Miller). Also identified from Brownsville (June) and Calhoun County.

Specimens of *townsendiana* have also been identified from Phoenix, Arizona (Aug.) and Ardmore, Oklahoma.

*Flower records.*—*Actinella, Helianthus debilis* and *Melanthera parviflora.*

**Megachile (Argyropile) nebraskana** Mitchell.

*Megachile* (*Argyropile*) *nebraskana* Mitchell, Trans. Am. Ent. Soc., LIX, p. 347, 1934.

The female was fully described in Part I of this revision. The male is yet to be discovered.

*Type.*—Female; War Bonnet Canyon, Sioux County, Nebraska, July 12, 1901, (M. Cary; on *Helianthus*), [Univ. Nebr.].

*Range.*—Texas, north to Utah, Colorado and Nebraska. Since the publication of the description of this species, four additional specimens have come to hand, as follows:

Colorado: 1♀, N.E. Larimer County, Aug. 27, 1935, (C. D. Michener).
New Mexico: 1♀, Carlsbad Caverns, May 16, 1927, (J. O. Martin).
Texas: 1♀, Fedor.
Utah: 1♀, Moab, June 18, 1933, (G. F. Knowlton).

*Flower records.—Helianthus, Monarda, Ratibida columnaria.*

**Megachile (Argyropile) sabinensis** Mitchell

*Megachile* (*Argyropile*) *sabinensis* Mitchell, Trans. Am. Ent. Soc., lix, p. 348, 1934.

Additional material of this species has been found since the unique specimen was described in PART I of this revision. The male is as yet unknown.

*Type.*—Female; Sabinal, Texas, May 1910, (T. C. Pratt), [U. S. N. M., no. 44252].

Texas: 1♀, Sanderson, June 10, 1930, (J. O. Martin). 1♀, Alpine, June 10, 1930, (G. Linsley), [all Cal. Acad Sci.].

Arizona: 1♀, Texas Canyon, Chiracahua Mts., Cochise Co., 5,000-6,000 ft., Sep. 16, 1927, (J. A. Kusche), [Cal. Acad. Sci.].

**Megachile (Argyropile) verbesinae** Cockerell

*Megachile verbesinae* Cockerell, Ann. Mag. Nat. Hist., (8), i, p. 264, 1908.

With the exception of the shape of the abdomen, which is given in the description as being parallel-sided, this species agrees with the characters of *parallela* in all details, so far as they are given, and it seems probable that the two names refer to the same species. None of the species in which the abdomen is strictly of the parallel-sided type have the sixth tergum as described above. Moreover, by a slight narrowing of the median abdominal terga, many of the forms with cordate or ovoid abdomen may appear to be somewhat parallel-sided.

No material of this species has as yet been examined personally. The following description has been transposed from the original description:

*Female.*—Size: Length about 15 mm.; breadth of abdomen 4.6 mm.

Structure: Clypeal margin straight, with a small median dentiform prominence, not projecting at all below the margin; mandibles 4-dentate; hind metatarsus much exceeding joints 2-5 combined; abdomen parallel-sided, the sixth tergum subhorizontal.

Puncturation: Clypeus shining, with well separated punctures.

Color: Black.

Pubescence: White, entirely so on mesonotum and scutellum, but vertex with some intermixed fuscous hairs, the dorsum of the thorax without conspicuous lines or fasciae of tomentum; abdominal terga with narrow entire white apical fasciae, the second with a small amount of obscure fuscous pubescence, the sixth with white tomentum; scopa entirely white.

## Subgenus LEPTORACHIS Mitchell

*Leptorachis* Mitchell, Trans. Am. Ent. Soc., LIX, p. 301, 1934.

*Leptorachis* is represented in the Nearctic Region by only a single species, all of the other recognized species occurring in the Neotropical Region. A list of these will be found in the reference cited above.

Tongue: Basal joint of labial palpus very slightly longer than the second, or the two subequal; maxillary palpi at most but very minutely pubescent, usually bare, the third joint usually somewhat longer and more slender than either of the others.

*Female.*—Mandible 4-dentate, the third tooth rather broadly truncate, a cutting edge between the third and fourth, the apical one not much longer than the second; basal joint of flagellum usually subequal to the second joint, somewhat longer than the pedicel; vertex very short, the hind margin deeply incurved and the lateral ocelli much nearer the edge of the vertex than to the eyes; mid and hind metatarsi about equalling their tibiae in width, but definitely shorter; abdomen cordate, sixth tergum more or less triangular in dorsal aspect, rounded apically, straight in profile, with abundant erect hairs visible; sixth sternum largely bare, but without a distinct bare lip beyond the apical fringe.

*Male.*—Mandible usually 4-dentate (3-dentate in the single Nearctic species), with a slender acute basal inferior projection; basal joint of flagellum subequal to or slightly longer than the pedicel, the second joint much longer; vertex much flattened, the hind margin much incurved, and the lateral ocelli usually somewhat nearer the edge of the vertex than to the eyes, although sometimes these distances are subequal; inferior angle of cheeks simple and unmodified; front coxae with relatively short slender acute spines, without red bristles, usually pubescent to some degree anteriorly; mid tibia with a rather small but definite apical spur; fifth tergum usually densely tomentose, often with a somewhat indefinite median ridge, and somewhat flattened on each side of this ridge; sixth tergum vertical, densely tomentose, the carina rather short, gradually narrowed apically, the apex with a rather deep and regular median emargination, the sides entire, apical margin of the tergum with teeth vestigeal or absent; seventh tergum inconspicuous; fourth sternum exposed, its apical margin usually broadly membranous.

**Male sternites: Fourth sternum exposed; fifth sternum not much modified, but with distinct presternal and medasternal areas; sixth sternum lacking distinct presternal and medasternal areas.**

**Genital armature: Stipites relatively simple more or less dilated, flattened and sinuate apically; sagittae less robust, but about equalling the stipites in length.**

GENOTYPE: *Megachile petulans* Cresson. [Orthotype.]

There are no published accounts of the nesting habits of the single species of this group occurring in North America, but one personal observation has been made. A female, later captured and identified as *petulans,* was observed flying near the surface of the ground where there were no blooms in evidence, and the presence of the nest was therefore suspected. It finally alighted and disappeared beneath the cover of growth. Continuing to watch the location, the bee was observed to leave shortly and a search was then made for the nest. It was well hidden under grass and weeds, but was finally located. After finding it, the watch was continued until the bee returned, holding a cut piece of leaf between the legs. She evidently had some difficulty in locating the nest after the disturbance of the growth, and it was only after resting a while on a leaf and then continuing to search that she succeeded in finding it. Upon her emergence after this second observed visit she was caught and the nest then dug up, as it was impossible to remain for further observations. The cell was only partially completed. It was located in the bottom of the burrow, about one and a half inches below the surface of the ground, and was nearly horizontal, the opening being on a slight slope.

**Megachile (Leptorachis) petulans** Cresson (Pls. V and VI.)

*Megachile petulans* Cresson, Trans. Am. Ent. Soc. VII, p. 127, 1878. Robertson, Can. Ent., XXXIV, p. 49, 1902. Robertson, Trans. Am. Ent. Soc., XXIX, p. 172, 1903. Friese, Das Tierr., Lfg. 28, Apidae I, p. 243, 1911. Cockerell, Proc. Ent. Soc. Wash., XVII, p. 4, 1915. Cresson, Mem. Am. Ent. Soc., I, p. 127, 1916. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 163, 1930.

*Megachile mexicana* Cresson, Trans. Am. Ent. Soc., VII, p. 127, 1878. Cresson, Mem. Am. Ent. Soc., I, p. 123, 1916.

*Megachile optive* (male) Robertson, Trans. Ac. St. Louis, VII (No. 14), p. 350, 1897.

*Female.*—Size: Length 11–12 mm.; breadth of abdomen 4–4.5 mm.; anterior wing 7–7.5 mm.

Structure: Face considerably broader than long; eyes slightly convergent below; clypeal margin slightly incurved medially, with a barely discernible median tubercle, otherwise entire; basal joint of flagellum subequal to the second joint, somewhat longer than the pedicel; cheeks much narower than eyes, especially above; second to fifth abdominal terga with shallow basal depressions, but the apical margin not appreciably depressed except at extreme sides of the fourth and fifth.

Puncturation: Fine and indistinct on cheeks; fine and very close on face and scutellum; slightly more coarse but quite close over most of mesonotum and pleura; coarse and sparse on vertex laterally and clypeus medially, more fine and close on the vertex medially and clypeus laterally; very fine and close over most of abdomen, although becoming somewhat deeper and more distinct on the fourth and fifth terga.

Color: Black; antennae and tegulae black or piceous; wings subhyaline basally, slightly clouded apically, the nervures brownish-yellow to piceous; spurs yellow.

Pubescence: Black and erect on vertex, mesonotum and scutellum, otherwise mostly white on head, thorax, legs and basal abdominal tergum, but with intermixed black hairs on face between antennae, and a patch of black hairs on pleura beneath each wing (this pleural patch absent in some individuals), and usually with some scattered black hairs on clypeus; very short and black on second to fifth abdominal terga, the sixth with numerous erect black hairs and extremely fine greyish tomentum; first to fifth terga with entire thin white apical fasciae, that on the first sometimes lacking, and the scutello-mesothoracic suture with a rather obscure pale fascia; a white hair-tuft behind each tegula; scopa very pale ochraceous, more white basally, darkened at apex of sixth sternum.

*Male.*—Size: Length 9–10 mm.; breadth of abdomen 3–3.5 mm.; anterior wing 5.5–6 mm.

Structure: Face somewhat broader than long; eyes convergent below; clypeal margin incurved or broadly emarginate medially; mandible 3-dentate, the middle tooth slightly emarginate and the mandible therefore approaching the 4-dentate condition, the inferior projection narrow, acute and basal; basal joint of flagellum subequal to pedicel, the second joint fully twice as long, the apical one neither dilated nor flattened; lateral ocelli only very slightly nearer edge of vertex than to eyes; vertex flat; cheeks narrower than eyes; front coxae thinly pubescent anteriorly, the spines rather small, acute, divergent; front femora slender; front tarsi simple, neither dilated nor flattened; abdomen rather broad and flat, the second to fourth terga rather deeply depressed basally, apical margins of the third to the fifth more or less depressed, deeply and abruptly so on the fifth, moderately so on the fourth, and only at sides on the third; carina of sixth tergum with the median emargination about as deep as broad, the apical margin of the tergum with no evident teeth; seventh tergum small, almost entirely hidden, not protuberant medially.

Sternites: Lateral portions of fifth presternite considerably longer than broad, with a very slight amount of pubescence apically, the median portion long linear, the medasternite demarked by an arcuate colorless band, but the margins indistinct, the apical half of the medasternite clothed with sparse, fine, simple setae, with a dense patch of these near the center, the poststernal strip with a nearly straight apical margin; lateral portions of sixth presternite longer than broad, each with a triangular apical projection, medasternal setae entirely lacking and the areas therefore not defined, the poststernal lobe broad and rather short, outcurved apically, without lateral angles, but with about eight uniformly spaced apical hairs.

Genital armature: Stipites narrowed above base, dilated and somewhat obliquely compressed medially, the tips rather abruptly flexed laterally, each with a small subapical trianglar knob on the inner side, the tip slightly dilated and bearing a few long bristles; sagittae rather slender, just perceptibly exceeding the stipites in length; volsellae quite robust, tapering and acute.

Puncturation: Minute and indistinct on shining cheeks, becoming rather coarse on vertex, rather close medially, more sparse laterally; rather fine and close on scutellum and around margin of mesonotum, slightly more coarse and rather widely separated on mesonotum medially; crowded and moderately coarse on pleura; fine and very close on abdomen basally, becoming slightly more coarse and distinct, but quite close, to the fourth tergum, closer on the fifth, but the punctures obscured by dense tomentum on the fifth and sixth.

Color: Black; antennae and tegulae more piceous; wings subhyaline, faintly clouded apically, the nervures ferruginous to fuscous; spurs yellowish.

Pubescence: Pale ochraceous or whitish in large part on head, thorax, legs, and basal abdominal terga, but vertex, mesonotum and scutellum with long erect fuscous hairs more or less intermixed with pale pubescence; third and fourth terga with pale tomentum across their extreme bases, otherwise short black pubescent, and this evident on the second tergum laterally in some specimens; fifth tergum largely covered with pale tomentum, but with erect black hairs evident apically; sixth tergum entirely covered with pale tomentum and with erect pale hairs; first to fourth terga with pale apical fasciae evident laterally, but inevident medially, the fifth not fasciate; scutello-mesothoracic suture with a rather obscure pale fascia.

*Type.*—Male: North Carolina, [A.N.S.P., no. 2451].

*Range.*—Florida to New Jersey and Pennsylvania, west to the Dakotas, Nebraska, Arizona, and Mexico, flying throughout the season. Definite records are as follows:

FLORIDA: 1♂, no locality record. 4♀, Cutler, Nov. 2, 1927, (S. Graenicher). 1♀, De Funiak Springs, Oct. 17–19, 1914. 1♂, Indian River. 1♂, 6♀, Jacksonville Beach, Aug. 5, 1936, (Mitchell). 8♂, 5♀, Miami, March 15 to Oct. 12, 1923–1927, (S. Graenicher). 1♀, Royal Palm Park, Nov. 25, 1927, (S. Graenicher). 2♂, 1♀, Titusville, April 25, 1923. Identified also from Crescent City, Fort Myers, Gainsville, Miami Beach and Monticello.

GEORGIA: 2♂, Tifton, June 19 & 21, 1896. Identified also from Savannah.

NEBRASKA: 1♂, Lincoln, July. 1♂, 4♀, Omaha, Aug. 8 & 9, 1913, (L. T. Williams; on *Melilotus alba* & *Campanula rotundifolia*). Identified also from Louisville, Nebraska City and So. Sioux City.

NEW JERSEY: 1♂, Clementon, Aug. 27, 1899. 1♂, Gloucester County, Aug. 16, 1891, (W. J. Fox). 5♀, Westville, Aug. 1, 1901.

NORTH CAROLINA: 2♂, 1♀, no locality record. 1♂, Aberdeen, June 28, 1930. 1♀, Acme, May 20, 1934, (on *Baptisia*). 1♂, Bryson City, July 28, 1922, (on *Koellia*). 1♂, 3♀, Burgaw, Sept. 10, 1928. 1♂, 1♀, Carolina Beach, June 20, 1930. 2♀, Carolina Beach, Sept. 12, 1931. 1♀, Cruso, June 27, 1934, (on *Chrysanthemum leucanthemum*). 1♀, Dixon, June 25, 1928, (on *Hypericum*). 1♀, Fayetteville, June 27, 1930. 1♂, Flat Rock, July 21, 1921. 2♂, Fort Fisher, June 22, 1929. 4♂, 3♀, Greensboro, Aug. 30 & 31, 1921. 4♀, Harker's Island, June 10 & 11, 1931, (on *Crotalaria*). 1♂, 6♀, Hartnett County, June 5, 1931, (on *Tephrosia*). 1♂, Hendersonville, July 12, 1923, (on *Coreopsis*). 1♂, Highlands, July 21, 1921, (on *Koellia*). 5♀, Hoffman, July 4, 1928. 1♂, Judson, July 19, 1923. 2♀, Kenansville, May 18 & 20, 1934, (on *Tephrosia*). 2♀, Kingsboro, June 9, (on *Trifolium*) and Aug. 2, (on Soybeans), 1932. 1♀, La Grange, July 27, 1921, (on *Lespedeza repens*). 12♀, Lakeview, Sept. 5 & 23, 1931 & 1933, (1♀ on blue *Gerardia*, 1♀ nesting in ground). 1♀, Lillington, Sept. 11, 1929. 1♂, Lumberton, June 22, 1928, (on *Koellia*). 2♀, Manteo, July 6, 1929. 1♂, 12♀, Marion, July 8 to Aug. 30, (on *Coreopsis stellata, Solidago* sp. and *Vernonia glauca;* 1♀, nesting in ground). 1♀, Marshall, July 5, 1928. 1♂, 7♀, Mars Hill, July 6, 1928. 1♂, McCuller's, Sept. 14, 1923, (on *Polygonum*). 2♀, Mt. Pisgah, June 23, 1934, (on *Houstonia purpurea*). 1♂, New Bern, June 27, 1923. 1♂, 1♀, Overhills, Sept. 12 & 13, 1921, (♀ on cult. *Buddleia*). 3♂, Pilot Mountain, July 19, 1931. 8♂, 3♀, Raleigh, late June to mid Sept., (on *Coreopsis* sp., *Helianthus atrorubens, Koellia* sp. and *Strophostyles* sp.). 3♀, Rocky Mount., July 14, 1933, (on *Trifolium* and cult. beans). 1♂, Sanford, June 6, 1922. 2♂, Southern Pines, Aug. 6, 1921, (on *Vernonia glauca*). 4♀, Southport, June 24, 1928, (on *Hypericum*). 1♂, Swannanoa, Aug. 5, 1922. 9♀, Tarheel, July 22, 1928, (on *Galactia* and *Helianthus*). 1♀, White Lake, July 22, 1928, (on *Galactia*). 2♂, Willard, July 6, 1922, (on *Galactia* & *Senecio*). 1♂, 1♀, Willard, June 22, 1929. 5♂, 30♀, Wilmington, June 22 to Sept. 12, (on Cult. beans, *Galactia, Hypericum* and *Koellia*); (all Mitchell). 1♂, Laurel

Hill, June 15, 1922, (W. B. Mabee). 6♂, Raleigh, June 18 to July 2, 1921, (C. S. Brimley).

PENNSYLVANIA: 1♀, no locality record. Identified from Philadelphia.

TENNESSEE: 1♀, no locality record,

VIRGINIA: 2♂, no locality record. Identified from Alexandria, Barcroft Falls Church, Glen Carlyn, Great Falls, Langley and Virginia Beach.

Additional specimens of *petulans* have been identified from the following localities: Alabama; Arkansas—Marion County; Illinois—Algonquin; Indiana—Clark County, Lafayette and Mineral Springs; Iowa—Sioux City; Kansas—Baldwin, Blue Rapids, Clay County, Dickinson County, and Riley County; Kentucky—Maud; Louisiana—Berwick; Maryland — Glen Echo; Mississippi; Missouri; North Dakota—Jamestown; Ohio—Marietta; South Carolina—Batesburg; Texas—Dallas and Lee County; Washington, D. C.; and West Virginia—Monongalia County.

*Flower records.*—This species visits a wide range of flowers, including many Composites and Legumes, as well as scattered representatives of other families such as *Campanula, Verbena, Gerardia, Polygonum, Pycnanthenum,* and *Hypericum.* Of the Composites, species of *Grindelia, Cirsium, Vernonia, Helenium, Rudbeckia, Coreopsis* and *Helianthus* are included in the records, while the Legumes are represented by species of *Cassia, Baptisia, Lespedeza, Strophostyles, Galactia* and *Tephrosia,* as well as cultivated beans.

### Subgenus **PSEUDOCENTRON** Mitchell

*Pseudocentron* Mitchell, Trans. Am. Ent. Soc., LIX, p. 303, 1934.

*Pseudocentron* is chiefly Neotropical in distribution, being represented by only two species in the Nearctic Region, and these found only in the more southern portion of the region. The Neotropical species are listed in the reference cited above.

Tongue: First and second joints of labial palpus subequal, or the second very slightly shorter than the first; maxillary palpi only very minutely pubescent at most, the third joint slightly longer than either of the others and slightly less robust.

*Female.* — Mandible 4-dentate, the third tooth acute, a cutting edge between the third and fourth, and an incomplete one between the second and the third; basal joint of flagellum longer than either the pedicel or the second joint, the latter but very slightly longer than the pedicel; middle and hind metatarsi somewhat shorter and narrower than their tibiae; abdomen cordate, the sixth tergum triangular in dorsal aspect, the apex more or less truncate, straight in profile, with only subappressed pubescence evident; sixth sternum largely bare, with a distinct apical lip protruding beyond the subapical fringe.

*Male.*—Mandible 4-dentate, the inferior projection basal, acute, the inferior margin of the mandible usually with a submedian tooth or angle; basal joint of flagellum considerably longer than pedicel, only very slightly shorter than the second joint; lower angle of cheeks slightly excavated and angulate, but this hidden by the dense pubescence; front coxae bare anteriorly, without red bristles, but with robust, much flattened spines; front femur strongly keeled beneath apically, the upper margin of the posterior face more or less conspicuously carinate apically; front tarsi usually broadly dilated and flattened; mid tibia lacking the apical spur, but often with spur-like apical angles or projections; abdomen more or less parallel-sided; sixth tergum vertical in position, with a low, usually emarginate carina, the apical margin of the tergum with low inconspicuous teeth or carinae; seventh tergum usually inconspicuous.

Male sternites: Fourth sternum exposed; medasternal area of fifth sternum much modified and variable in form; sixth sternum nearly as extensive as the fifth.

Genital armature: Stipites much modified, with extremely large apical lobes and protuberances; sagittae slender and unmodified.

GENOTYPE: *Megachile pruina* Smith. [Orthotype.]

Although there are no published accounts of the nesting habits of either of the Nearctic species of this group, an indication of the type of nest built is to be found in a note published by Cresson [4] on the nest of *poeyi*, which is a West Indian representative of the group. The nest of this species was described as being composed of leaves, and was located beneath stones.

## *Key to Species of Pseudocentron* [5]

### Females

1. Outer surface of mid metatarsus with entirely white pubescence. *sidalceae* Cockerell
   Outer surface of mid metatarsus with purplish-fuscous or black pubescence ........ 2
2. Abdomen without pale fasciae, the pubescence being entirely black. *morio* Smith
   Abdomen with conspicuous pale fasciae ........ 3
3. Pubescence of face, cheeks, pleura, propodeum, legs and abdomen basally, fuscous ........ *pruina* var. *nigropinguis* new variety
   Pubescence of face, pleura, etc. largely white ........ *pruina* Smith

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[4] Proc. Ent. Soc. Phil., IV, p. 1, 1865.

[5] See also *bidentata* (p. 73).

## Males

1. Mesonotum with a large patch of black pubescence; mandibles with but a very small tuft of yellowish pubescence; second, third and fourth abdominal terga with black pubescence, the fifth and sixth white pubescent ............................................ *pruina* Smith
   Mesonotum without black pubescence; mandibles each with a large tuft of yellowish pubescence; first to fourth abdominal terga with pale pubescence, that on the fifth and sixth black ...... *sidalceae* Cockerell

**Megachile (Pseudocentron) pruina** Smith (Pls. V and VI.)

*Megachile pruina* Smith, Cat. Hym. Brit. Mus., I, p. 190, 1853. Cresson, Trans. Am. Ent. Soc., IV, p. 268, 1872, (= *parallela*). Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 11, 1900, (= *parallela*). Cockerell, Can. Ent., XXXV, p. 215, 1903, (= *parallela*). Cockerell, Trans. Am. Ent. Soc., XXXI, p. 337, 1905. Friese, Das Tierr., Lfg. 28, Apidae I, p. 244, 1911, (= *parallela*). Mitchell, Psyche, XXXIII, p. 163, 1926, (= *parallela*). Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

*Megachile pinguis* Cresson, Trans. Am. Ent. Soc., VII, p. 126, 1878. Friese, Das Tierr., Lfg. 28, Apidae I, p. 244, 1911. Cresson, Mem. Am. Ent. Soc., I, p. 128, 1916.

*Megachile floridana* Robertson, Trans. Am. Ent. Soc., XXII, p. 125, 1895. Friese, Das Tierr, Lfg. 28, Apidae I, p. 237, 1911. Mitchell, Psyche XXXIV, p. 179, 1927.

*Megachile shermani* Mitchell, Journ. Elisha Mitchell Soc., XL, p. 163, 1924. Mitchell, Trans. Am. Ent. Soc., LII, p. 113, 1926.

*Megachile pruina* var. *bermudensis* Mitchell, Psyche, XXXVI, p. 93, 1929.

There is much variability as to the amount of black pubescence in this species, specimens from Florida tending to show relatively more, while others from the more northern parts of its range show much less black pubescence. The description below is based on Florida material. Some males from North Carolina are entirely lacking in black pubescence on the dorsum of the thorax, and females from the same region have little or no black pubescence on the face or clypeus, and there is less black in the scopa of the apical abdominal sterna. The wings tend to be darker in Florida material, paler in specimens from North Carolina. A single female from Bermuda, described as var. *bermudensis* (see reference above) agrees rather well therefore with the North Carolina form, specimens of which had not been obtained until after *bermudensis* had been described.

*Female.*—Size: Length 12–13 mm.; breadth of abdomen 4–4.5 mm.; anterior wing 8–8.5 mm.

Structure: Face broader than long; eyes slightly convergent below; clypeal margin nearly straight and entire, with a median more or less shining area; basal joint of flagellum much longer than pedicel, and slightly longer than the second joint; lateral ocelli slightly nearer edge of vertex than to eyes; vertex flat; cheeks slightly narrower than eyes; second and third abdominal terga distinctly depressed basally, the fourth considerably less so, apical margins of the second to the fifth more or less depressed, more so laterally and on the more apical terga; sixth tergum triangular in dorsal aspect, the apex subtruncate, straight in profile with only suberect hairs visible.

Puncturation: Fine and close on cheeks, face, mesonotum anteriorly and pleura above; more coarse and distinctly separated on vertex, mesonotum and scutellum; irregular on clypeus, close except along median line; fine and close on abdomen basally and on the sixth tergum, becoming increasingly more coarse and distinctly separated toward the fifth tergum.

Color: Black; antennae piceous beneath; tegulae blackish or piceous, yellowish anteriorly; wings lightly infuscated, slightly more deeply so apically, the nervures ferruginous to fuscous; spurs brownish-yellow.

Pubescence: Mostly white on head, thorax, legs and basal abdominal segment; short and black on vertex, mesonotum, scutellum, and second to fifth abdominal terga; face and clypeus with more or less of an admixture of black hairs, and legs with scattered fuscous hairs, the mid metatarsus with dense purplish-fuscous pubescence on the outer face, all of the tarsi clothed beneath with the same color; second to fifth abdominal terga with narrow white apical fasciae, the sixth with very fine pale tomentum and longer black hairs, the latter erect laterally, subappressed medially; scutello-mesothoracic suture obscurely white-fasciate, and mesonotum with obscure anterior oblique lines of whitish tomentum, a rather distinct white hair tuft behind each tegula; scopa white, black on the fifth and sixth sterna, and a few black hairs laterally on the fourth.

*Male.*—Size: Length 11–12 mm.; breadth of abdomen 3.7–4 mm.; anterior wing 8–8.5 mm.

Structure: Face about as broad as long; eyes very slightly convergent below; clypeal margin entire, very slightly and broadly outcurved; mandible with an acute inferior projection, the median inferior tooth rather small; basal joint of flagellum much longer than the pedicel, nearly equalling the second joint, the apical one neither dilated nor flattened; lateral ocelli subequally distant from eyes and edge of vertex, slightly nearer to each other; vertex flat; cheeks subequal to eyes in width; front coxae bare anteriorly, the spines flattened, of moderate length, rounded apically; front metatarsus subequal to the second to fourth joints combined in length, more broadly dilated apically than basally, but only slightly produced apically, the anterior margin with a rather shallow excavation; mid tibia produced apically into a slender spur-like spine, the inner margin not angulate; mid and hind metatarsi considerably longer than broad, relatively slender; abdomen rather robust, parallel-sided, the terga only slightly depressed basally and apically, the apical depressions more marked laterally; sixth tergum vertical, the carina short, with a rather definite though small and shallow median emargination, very slightly and irregularly crenulate on each side, the apical margin of the tergum with very low carinate median teeth which are nearer the minute lateral teeth than to each other; seventh tergum transverse, the carinate tip barely evident.

Sternites: Lateral portions of fifth presternite subtriangular, the apical angle of the triangle rounded, the medasternite restricted in area, its apical margin with an abrupt emargination in which is located an elongate tapering and acute median lobe, a rather elongate wing-like lobe on each side of medasternite, the surface of the medasternite well covered with fine setae or pubescence, that along the apical margin long, especially on each side where the setae are curved and abruptly flexed apically, the poststernal strip evident only laterally, beyond the tips of the medasternal lobes; lateral portions of sixth presternite restricted in area, forming only the extreme lateral margins of the plate apparently, the medasternal areas extensive, distinctly separated medially, apical margins strongly carinate and slightly recurved, extended as a rather broad lobe at each extreme side, the apical margin with robust setae, the more lateral of which are very long and directed medially, the poststernal lobe elongate, narrow basally, broadened apically, the lateral angles attenuate.

Genital armature: Stipites gradually narrowed from base to near the tip, bilobate apically, the dorsal lobe flexed inwardly, its oblique apical margin shallowly excavated, the ventral lobe extremely robust, more or less rounded, but with its ventral surface deeply excavated; sagittae relatively slender and simple, considerably shorter than the stipites; volsellae barely evident, triangular, with narrowly rounded apex.

Puncturation: Fine and close on cheeks below, mesonotum anteriorly and laterally, and on pleura; more coarse and distinctly separated in center of mesonotum, on scutellum, and on vertex medially, more sparse on vertex laterally; fine and close on abdomen basally, becoming more coarse but still quite close on the more apical terga, but the fifth rather coarsely rugoso-punctate, and the sixth more finely so, with scattered small tubercles over the surface.

Color: Black, antennae reddish-piceous beneath, tegulae yellowish-ferruginous, with piceous blotches; wings lightly infuscated, more deeply so apically, the nervures ferruginous; front femur dark on apical portion of posterior face, the edge of the keel bright yellow, otherwise mostly yellowish or ferruginous; outer face of front tibia dark except for the yellow apex, the other two faces more ferruginous; all the tarsi yellow, but the second joint of the front tarsus with a dark spot beneath, the mid and hind tarsi rimmed with piceous posteriorly, and the more apical joints of the hind tarsi largely dark.

Pubescence: Pale ochraceous and dense on face and clypeus, otherwise mostly white on head, thorax, legs and basal abdominal segment, but the vertex, mesonotum and second to fourth abdominal terga with considerable erect black pubescence, the scutellum with black hairs intermixed with the white, the fifth and sixth segments with entirely pale erect pubescence and with no pale tomentum; second to fifth terga with entire white apical fasciae, these thin on the more basal terga; scutello-mesothoracic suture only obscurely fasciate, and the mesonotum with only very obscure anterior lines of tomentum.

*Type.*—Female; (E. D. R. A.), [Brit. Mus.].

*Range.*—Florida to North Carolina along the coast, and west to Galveston, Texas, April to November. Definite records are as follows:

FLORIDA: 1♂, Biscayne Bay. 1♂, 1♀, Cedar Keys, (Agr. Exp. Sta. J. R. W.; on *Helianthus*). 1♀, Gordon's Pass, May 7, 1934, (H. Pearson). 3♀. Miami, Aug. 6 and Oct. 23, 1927, (Graenicher). 1♂, 1♀, Miami, July 15, 1923 and June 6, 1924. 1♂, Miami Beach, Oct. 25, 1934, (H. Pearson). 2♀, Royal Palm Park, Apr. 12–18, 1923. Identified also from Flamingo, Apr. 13, 1923, Homestead, July 23, 1926, Key Largo, Nov., and Long Key, Apr. 19, 1923.

NORTH CAROLINA: 1♀, Carolina Beach, June 12, 1930, (on *Asclepias tuberosa*). 3♀, Carolina Beach, Sept. 12 & 13, 1931, (on *Strophostyles*). 1♂, 1♀, Harker's Island, June 12, 1931, (on *Crotalaria*), 1♀, Morehead, Sep. 6–8, 1936; (all Mitchell).

Males of *pruina* have also been identified from Galveston, Texas, June.

*Flower records.*—*Helianthus* sp., *Crotalaria* sp., *Cuscuta* sp. *Asclepias tuberosa*, and *Strophostyles* sp. Graenicher records the species on *Dalbergia ecastophyllum*, *Melanthera parvifolia*, *Croton linearis*, *Galactia floridana* and *Vernonia Blodgettii.*

### **Megachile (Pseudocentron) pruina** var. **nigropinguis** new variety

It is not possible to be positive regarding the distinction between this form and typical *pruina* until more material has been obtained. Typical male *pruina* has been taken at Galveston, and it seems therefore safer to assume that this form is a color variant of the female only and not a distinct species.

*Female.*—Size: Length 13 mm.; breadth of abdomen 5 mm.; anterior wing 9 mm.

Structure: Identical with typical *pruina* except that the abdomen is somewhat broader and more robust.

Puncturation: Similar to *pruina*, but the vertex and the mesonotum more closely punctate.

Color: Black; antennae brownish-piceous beneath; tegulae piceous; wings faintly infuscated basally, more deeply so apically, the nervures piceous; spurs yellowish.

Pubescence: Almost entirely fuscous, but somewhat paler in front and behind the wing bases, and the scutello-mesothoracic suture brownish-fasciate, the second to fifth abdominal terga with brownish-ochraceous apical fasciae; legs largely fuscous pubescent, but the hind femora and tibiae with pale tomentum on lower or inner faces; scopa white on the median portions of the second to fourth sterna, otherwise black or fuscous.

*Type.*—Female; Galveston, Texas, May, (F. E. Snow), [Univ. Kansas].

*Paratype.*—One female, topotypical.

**Megachile (Pseudocentron) sidalceae** Cockerell (Pl. VI.)

*Megachile sidalceae* Cockerell, Trans. Am. Ent. Soc., xxiv, p. 158, 1897. Cockerell, Denison Univ. Bull., xi, p. 65, 1898. Cockerell, Entomologist, xxxii, *p.* 158, 1899. Cockerell, Ann. Mag. Nat. Hist., (7), vi, p. 15, 1900. Friese, Das Tierr. Lfg. 28, Apidae i, p. 246, 1911. Cockerell, Proc. Calif. Ac. Sc., (4), xii, p. 548, 1924. Mitchell, Psyche, xxxiv, p. 179, 1927.

*Megachile abducta* Mitchell, Trans. Am. Ent. Soc., lii, p. 111, 1926.

*Female.*—Size: Length 13–14 mm.; breadth of abdomen 4–4.5 mm.; anterior wing 9–10 mm.

Structure: Face slightly broader than long; eyes slightly convergent below; clypeal margin with a narrow median shining produced area, otherwise entire; basal joint of flagellum longer than the second joint, the latter slightly longer than the pedicel; lateral ocelli subequally distant from eyes and edge of vertex; vertex flat; cheeks subequal to eyes in width; third abdominal tergum rather deeply depressed basally, the second and fourth less deeply so, apical margins of the second to the fifth more or less depressed, more so laterally and on the more apical terga; sixth tergum somewhat triangular in dorsal aspect, the apex subtruncate, nearly straight in profile with no definitely erect pubescence visible.

Puncturation: Fine and close on cheeks and on mesonotum laterally and anteriorly; more distinctly separated on scutellum and on mesonotum medially; more coarse on clypeus and vertex, rather sparse on clypeus medially and on vertex laterally; rather coarse and close on pleura; very fine and close on abdomen basally and on the sixth tergum, becoming more coarse and distinct though quite close to the fifth.

Color: Black; antennae reddish-piceous beneath; tegulae ferruginous or yellowish with fuscous patches; wings subhyaline, slightly clouded apically, the nervures ferruginous to piceous; spurs yellow.

Pubescence: Mostly white on head, thorax, legs and basal abdominal segment, but short and black on vertex, mesonotum, scutellum and second to fifth abdominal terga, the sixth with whitish tomentum and scattered longer subappressed black hairs, these longer and erect toward the sides basally; first to fifth terga with entire white apical fasciae, the scutello-mesothoracic suture white-fasciate, a similar fascia along the lower margin of the scutellum, and the mesonotum with rather conspicuous anterior oblique lines of white tomentum, with a white tuft behind each tegula; scopa white, black in part on the sixth sternum.

*Male.*—Size: Length 11–14 mm.; breadth of abdomen 3.5–4 mm.; anterior wing 8–10 mm.

Structure: Face about as broad as long; eyes very slightly convergent below; clypeal margin entire, very slightly outcurved; mandible with an acute inferior projection, the inferior median tooth also acute and conspicuous; basal joint of flagellum only slightly shorter than the second joint, considerably longer than the pedicel, the apical one neither dilated nor flattened; lateral ocelli subequally distant from eyes, edge of vertex, and from each other; vertex flat; cheeks subequal in width to eyes; front coxae bare and shining anteriorly, the spines long, flattened, rounded apically, spatulate; front metatarsus more broadly dilated apically than basally, the apex somewhat produced; mid tibia with a rather slender spine-like apical projection, the inner margin not angulate; mid and hind metatarsi considerably longer than broad, relatively slender; abdomen rather robust, parallel-sided, the terga slightly depressed basally and apically, the apical depressions more evident toward the sides; sixth tergum vertical in position, the low carina with an indefinite median emargination, irregularly serrate or dentate on each side, the apical margin of the tergum with very low carinate median teeth which are nearer the acute lateral teeth than to each other; the carinate rim of the seventh tergum just barely evident.

Sternites: Lateral portions of fifth presternite subtriangular, but apical angle broadly obliquely truncate, the medasternite broad, but very short, its basal portion broadly incurved, produced into broad acute lobes on each extreme side, its apical margin with a robust triangular median protuberance and on each side of this a broad and nearly straight lobe, these with long fine pubescence, while the basal portion is closely beset with curved setae, the median apical protuberance bearing a pair of extremely long tufts of setae, these about equalling the lateral portions of the presternite in length, the poststernal strip evident only as a pair of elongate lobes extending beyond the lateral limits of the medasternite; lateral portions of sixth presternite limited in area, long and narrow, covered in part by the lateral expansions of the medasternal areas, these separated medially, the inner portion of each occupied by a rather broad closely setose area, while laterally the setae are confined to the thickened apical margin, the poststernal lobe elongate, narrow basally, the apex broadly expanded by the extensions of the lateral angles.

Genital armature: Stipites slightly curved but almost parallel-sided medially, the dorsal portion of apex occupied by a pair of conspicuous opposing finger-like processes between which is a deep rounded excavation, the ventral portion occupied by an extremely large, rounded and deeply excavated lobe; sagittae slender, slightly shorter than the stipites; volsellae obscure, subtriangular, with rounded apex.

Puncturation: Fine and close on mesonotum laterally and anteriorly and on upper part of pleura, distinctly separated on mesonotum medially and on scutellum; moderately coarse and quite sparse on vertex, becoming very fine and indefinite on cheeks; more coarse but close on pleura below; very fine and close on abdomen basally, becoming increasingly more coarse and sparse on the more apical shining terga, but the sixth rather finely rugoso-punctate.

Color: Black; antennae more ferruginous beneath; tegulae ferruginous with darker blotches; wings subhyaline, slightly clouded apically the nervures ferruginous; front femur yellowish-ferruginous except for the dark apical portion of posterior face, the edge of the keel however bright yellow; front tibia dark on outer face but yellow apically, the other two faces ferruginous; mid and hind femora and tibiae black; all the tarsi bright yellow, second joint of the front tarsus with a dark spot beneath, mid and hind tarsi with the posterior margins darkened; spurs yellow.

Pubescence: Dense and pale ochraceous on face and clypeus, otherwise largely white on head, thorax, legs and basal abdominal segment, very thin on dorsum of thorax, with some short inconspicuous dark hairs on vertex laterally; pale ochraceous on second to fourth abdominal terga, black and erect on the fifth and sixth; first to fifth terga with entire white apical fasciae, but the abdomen otherwise entirely lacking pale tomentum; scutello-mesothoracic suture distinctly white-fasciate, the mesonotum with a pair of oblique anterior lines of white tomentum, and a dense white hair tuft behind each tegula; front tarsal fringe rather pale ochraceous above, brownish beneath.

*Type.*—Male; [Cockerell, B 28].

*Range.*—Texas to Southern California, south into Mexico, April to July. Definite records are as follows:

ARIZONA: 1♂, Southern Arizona. 2♀, Baboquivari Mts., near Kits Peak, Aug. 7–9, 1916. 1♀, Comobabi Mts., Aug. 9–10, 1916. 3♂, Congress, June, July, (Snow). 2♀, Douglas, July 6, (or June 7), 1934, (W. W. Jones). 1♂, 3♀, Dragoon, Cochise County, July 20, 1917, (on *Prosopis glandulosa*). 1♀, Florence, July 13, 1903, (C. R. Biederman). 1♀, Florence, July 28, 1917. 1♂, Globe, July 25. 2♂, 25 miles east of Sonorita, Aug. 9, 1924, (E. P. Van Duzee). 2♀, S. Carlos, May 12 & 13, 1918, (J. C. Bradley). 4♂, Tempe, July 31–Aug. 4, 1917. 7♂, 1♀, Tucson, (F. H. Snow). 2♂, 2♀, 18 miles south of Tucson, July 31, 1924, (E. P.

Van Duzee). 1♀, 36 miles southwest of Tucson, Aug. 3, 1932, (R. B. Painter) [Sabrosky]. Identified also from Bill Williams Fork, (Aug.), and Palmerlee.

California: 1♂, no locality record, (C. F. Baker). 2♀, Blythe, Aug. 20, 1927. Identified also from Jacumba.

New Mexico: 1♂, Mesilla Park, May 17, 1909, (C. N. Ainslie). Identified also from Las Cruces.

Texas: 18♂, 12♀, Bexar County, May 30 to Sept. 25, (Parks). Identified also from Brownsville (June), Cotulla, Galveston (May), Laguna, Midland, Monahan's and New Braunfels.

*Sidalceae* has also been identified from Hermosillo, Mexico.

*Flower records.*—*Prosopis glandulosa* is the only record on the material at hand. Cockerell records it on *Sidalcea malvaeflora*, and on species of *Prosopis, Helianthus, Isocoma, Senecio* and *Pectis*.

**Megachile (Pseudocentron) morio** Smith

*Megachile morio* Smith, Cat. Hym. Brit. Mus., I, p. 189, 1853. Friese, Das Tierr., Lfg. 28, Apidae I, p. 242, 1911. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930 (=*floridensis*).

This description was made from a specimen loaned by the British Museum, apparently of the type series, and the only specimen known other than the type. According to Mr. O. W. Richards it is identical with the type.

No other material of this species has been found in any of the collections of Nearctic bees examined. It was supposed to have been caught in Florida, and has been confused therefore with a species of the group *Melanosarus* occurring in southern Florida. It may possibly be of rare occurrence in that area, or it may have been originally captured in the West Indies or in Mexico.

*Female.*—Size: Length 13 mm.; breadth of abdomen 5 mm.; anterior wing 9 mm.

Structure: Face about as long as broad; eyes somewhat convergent below; clypeal margin straight, with a very minute and scarcely discernible median tubercle in the center of a shallow and barely visible emarginate area; mandibles 4-dentate, the cutting edge between the median teeth abruptly truncated about midway between them, that between the two inner teeth entire; basal joint of flagellum fully twice the length of the pedicel and slightly longer than the second joint; lateral ocelli somewhat nearer edge of vertex than to eyes (as about 9:14); vertex flat; cheeks subequal in width to eyes; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen broadly cordate, the apical margins of the terga distinctly depressed laterally but not at all medially, the second and third somewhat grooved basally, the fourth slightly so, the sixth straight in profile, with the hairs largely appressed medially.

Puncturation: Very close and fine on cheeks, pleura above, and mesonotum anteriorly; fine but more distinct on the shining scutellum; slightly more coarse but very close on pleura below; rather coarse and sparse on the shining mesonotum; rather sparse and of two distinct sizes on the shining vertex; quite coarse on clypeus, sparse medially and on supraclypeal area; minute and dense on abdomen basally, becoming quite distinct and relatively sparse on the fifth tergum, but minute and densely crowded on the sixth.

Color: Black; antennae brownish-fuscous beneath; tegulae black; wings rather uniformly infuscated, the nervures black or fuscous; spurs yellow.

Pubescence: Abdomen with inconspicuous but entire fuscous apical fasciae, the pubescence otherwise entirely black, including the scopa, very dense on inner orbits, around wing bases, and across the basal abdominal tergum.

*Type.*—Female; " U. S.," [Brit. Mus.].

*Range.*—No locality record other than "North America" given.

**Megachile (Pseudocentron) bidentata** Fabricius

*Andrena bidentata* Fabricius, Syst. Ent., p. 377, 1775. Fabricius, Spec. Insect., I, p. 474, 1781. Fabricius, Mant. Insect., I, p. 299, 1787. Olivier, Encyc. Method., IV, p. 137, 1789. Fabricius, Ent. Syst., II, p. 313, 1793.

*Apis bidentata* Gmelin (Linne), Syst. Nat., (13), v, p. 2793, 1790.

*Anthophora bidentata* Fabricius, Syst. Piez., p. 381, 1804.

*Megachile* (?) *bidentata* Dalla Torre, Cat. Hym., x, p. 422, 1896. Friese, Das Tierr., Lfg. 28, Apidae I, p. 248, 1911.

Specimens of both *pruina* and *sidalceae* have been compared with the type of *bidentata* in the British Museum by Mr. O. W. Richards. It appears to be distinct from either one of these, but to belong to the group *Pseudocentron.* No other specimens have been found in any of the collections of North American bees which have been studied, and it seems probable that it is Neotropical in distribution rather than Nearctic. The following notes were made by Mr. Richards:

"*Male.*—Whole front of head with very dense creamy yellow hairs. Mandibles rather broad, apparently with two teeth at apex and another near the middle of the lower margin. Basal half of mandibles dull owing to dense microscopic tomentum, just before middle a tuft of dense yellowish pubescence. Antennal segments 4–13 elongate, more than twice as long as broad. Fore legs very moldy, but metatarsus very broad and white, other segments probably white. Mid metatarsus also white, with a black posterior margin and a very long fringe of hairs both anteriorly and posteriorly. Abdomen moderately shining, with not very close, rather fine punctures, becoming stronger on tergite 5. Most of the tergites with short black and a few pale hairs, but apex 1–5 with dense orange-brown bands. Base of tergite 1 with long pale hairs. 6th tergite very strongly bidentate, sparsely punctate."

## Subgenus **ACENTRON** Mitchell

*Acentron* Mitchell, Trans. Am. Ent. Soc., LIX, p. 303, 1934.

*Acentron* is closely related to *Pseudocentron*. It is represented in North America by a single species, but there are four or more other Neotropical species that evidently belong in it. These are listed in the reference cited above.

Tongue: First and second joints of labial palpus subequal, or the second very slightly shorter than the first; maxillary palpi only very minutely pubescent at most, the third joint slightly longer than either of the others and slightly less robust.

*Female.*—Mandible 4-dentate, the third tooth truncate, a cutting edge between the third and fourth teeth only, apical tooth much larger and more prominent than the second; basal joint of flagellum longer than pedicel and usually longer than the second joint; hind metatarsi fully as broad and as long as their tibiae, the mid metatarsi shorter than their tibiae but subequal to them in width; abdomen cordate, the sixth tergum more or less broadly rounded or truncate apically, straight in profile, with at most only suberect hairs visible; sixth sternum largely bare, with a distinct bare apical lip projecting beyond the subapical fringe.

*Male.*—Mandible 4-dentate, the inferior projection robust, subbasal, the inferior margin without a median tooth, although the apical limit of the inferior projection may be indicated by a more or less pronounced angle; basal joint of flagellum subequal to the second joint, considerably longer than the pedicel; inferior angle of cheek with a rounded more or less concave protuberance; front coxae bare anteriorly, without red bristles, but with long conspicuous spines; inferior margin of front femur apically only slightly keeled; front metatarsus much dilated and highly modified; mid tibia lacking the apical spur, more or less dilated apically but without spur-like protuberances; abdomen rather short, parallel-sided, the fifth tergum usually conspicuously tomentose, at least basally; sixth tergum vertical, densely tomentose above the low medially emarginate carina, apical margin of the tergum with hardly evident teeth; seventh tergum inconspicuous.

Male sternites: Fourth sternum exposed; fifth presternite extensive, the medasternite distinct, setose, modified in form; sixth presternite extensive laterally, the medasternal areas widely separated, highly modified, the poststernal lobe short, rounded apically.

Genital armature: Stipites more or less dilated apically, with rather slender protuberances; sagittae slender, slightly shorter than stipites; volsellae robust.

GENOTYPE: *Megachile albitarsis* Cresson. [Orthotype.]

**Megachile (Acentron) albitarsis** Cresson (Pls. V and VI.)

*Megachile albitarsis* Cresson, Trans. Am. Ent. Soc., IV, p. 263, 1872. Friese, Das Tierr., Lfg. 28, Apidae I, p. 234, 1911. Cresson, Mem. Am. Ent. Soc., I, p. 111, 1916. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

*Megachile optiva* Cresson, Trans. Am. Ent. Soc., IV, p. 268, 1872. Provancher, Nat. Can., XIII, p. 232, 1882, (=*relativa*). Provancher, Fauna Ent. Can. Hym., p. 710 & 715, 1883, (=*relativa*). Robertson, Trans. Ac. St. Louis, VII, (no. 14), p. 350, 1897, (♂=*petulans*). Robertson, Can. Ent., XXXIV, p. 49, 1902. Friese, Das Tierr., Lfg. 28, Apidae I, p. 243, 1911. Cresson, Mem. Am. Ent. Soc., I, p. 126, 1916. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

*Megachile newelli* Cockerell, Ann. Mag. Nat. Hist., (8), I, p. 262, 1908. Cockerell, Ann. Mag. Nat. Hist., (8), XIII, p. 432, 1914.

*Megachile kallstraemiae* Cockerell, Ann. Mag. Nat. Hist., (8), I, p. 264, 1908.

*Female.*—Size: Length 12–13 mm.; breadth of abdomen 4.5 mm.; anterior wing 8 mm.

Structure: Face broader than long; eyes subparallel; clypeal margin with a small but definite median tubercle, slightly emarginate on each side of this, otherwise nearly straight; lateral ocelli subequally distant from eyes, edge of vertex, and each other; vertex flat; cheeks subequal to eyes in width; second and third abdominal terga slightly depressd basally, the second to the fifth with the apical margins more or less depressed, deeply so laterally, but only very obscurely so medially; sixth tergum subtruncate apically, straight in profile with only a few suberect hairs visible toward the base.

Puncturation: Close and fine over entire thorax, and also on each side of middle on vertex, more sparse medially and laterally; slightly more coarse, deep, and more distinctly separated on clypeus and supra-clypeal area; fine and sparse on cheeks, especially below; minute and close over most of abdomen, especially toward base and on sixth tergum.

Color: Black; antennae piceous beneath; tegulae piceous to ferruginous; wings faintly clouded basally, more deeply so apically, the nervures ferruginous to piceous; spurs yellow.

Pubescence: White on face, cheeks, pleura, propodeum, legs and basal abdominal segment; black on vertex, mesonotum, scutellum and second to fifth abdominal terga, the sixth with fine pale tomentum and short subappressed black hairs, with longer erect black hairs toward the base laterally; first to fifth terga with entire whitish apical fasciae, the scutellomesothoracic suture white-fasciate, the mesonotum with a pair of oblique narrow lines of white tomentum anteriorly, and with a small dense white tuft behind each tegula; scopa entirely white with the possible exception of darker hairs on the sixth sternum laterally and apically.

*Male.*—Size: Length 11–12 mm.; breadth of abdomen 4 mm.; anterior wing 7.5–8 mm.

Structure: Face about as long as broad; eyes very slightly convergent below; clypeal margin with a slight median protuberance and a somewhat more robust one on each side of this; inferior projection of mandible subbasal, relatively small, subacute; first and second joints of flagellum subequal, each considerably longer than the pedicel, the apical one somewhat dilated and flattened; lateral ocelli slightly nearer eyes than to edge of vertex, subequally distant from eyes and each other; vertex flattened; cheeks slightly broader than eyes; front coxae bare and shining anteriorly, the spines broad and flat basally, quite abruptly narrowed midway to apex, the apical portion more slender; front metatarsus subequal in length to the second to fifth joints combined, slightly more broadly dilated apically than basally, but only slightly produced apically, only slightly excavated anteriorly, the second joint somewhat broader than long; mid coxa with a short acute tooth or spine; mid tibia dilated apically, inner margin terminated apically by a short, obliquely truncate and more or less carinate protuberance; mid metatarsus broadly dilated and flattened basally and medially, narrowed apically, the posterior margin evenly rounded; hind metatarsi simple, flattened, more than twice as long as broad; second and third abdominal terga somewhat depressed basally, the apical margins of the second to the fifth more or less depressed, much so on the more apical segments, less so medially and on the more basal segments; carina of sixth tergum very short and inconspicuous, with a small and shallow but definite median emargination, entire laterally, apical margin of the tergum without evident teeth; seventh tergum barely evident, transverse, lacking any median protuberance or spine.

Sternites: Lateral portions of fifth presternite with length and breadth subequal, apical margin of each broadly angular, the apical half transparant, with deeply pigmented margins, and the median portion deeply pigmented, not at all linear, medasternite closely beset with rather fine simple setae, its basal margins broadly rounded, apical margins with a rather broad emarginate median area, oblique on each side of this, the emargination occupied by a median tuft of six parallel and very robust spine-like setae, the poststernal strip evident only laterally where it is expanded into broad triangular lobes; lateral portions of sixth presternite subtriangular, transparent, with deeply pigmented margins, the apical one broad, outcurved, medasternal areas widely separated, inner apical margins oblique and carinate, each area about as broad as long and closely covered with short robust modified setae, the median poststernal lobe present, but short, rounded, and rounded lateral lobes also evident beyond each medasternal area, the poststernal area deeply incurved between these three lobes.

Genital armature: Stipites rather slender and elongate, with a subapical dilation which is closely beset on the inner surface with short setae, outer portion of apex prolonged into a rather slender protuberance, and a much shorter and smaller protuberance on inner side of apex; sagittae long, slender, slightly sinuate, very slightly shorter than stipites; volsellae triangularly acute.

Puncturation: Very fine and densely crowded on cheeks, mesonotum and pleura above; slightly more coarse but quite close on vertex and scutellum; venter of thorax almost impunctate; very fine and close on abdomen basally, becoming more coarse but still quite close to the fifth tergum.

Color: Black; antennae brownish-piceous beneath; tegulae yellowish around the margin; wings faintly yellowish basally, more deeply clouded apically, the nervures ferruginous; front femur and tibia largely ferruginous, the femur more yellowish on anterior face and to some degree on upper face; front tarsi yellow, the second joint with a black spot beneath; mid tibia ferruginous anteriorly, more fuscous posteriorly; mid and hind tarsi yellow; hind femora and tibiae dark; spurs yellow.

Pubescence: Entirely pale ochraceous, with no dark admixture, but sixth abdominal tergum densely covered with white tomentum, and the front tarsal fringe more whitish above, the metatarsus quite densely covered beneath with appressed scale-like, fuscous pubescence, the two anterior margins fringed in part at least with fuscous setae; abdominal terga with ochraceous apical fasciae, these obscure medially, more evidently laterally, the fifth tergum with ochraceous tomentum basally; scutello-mesothoracic suture ochraceous-fasciate, and mesonotum with a pair of rather obscure anterior patches of ochraceous tomentum.

*Type.*—Male; Texas, [A.N.S.P., no. 2461].

*Range.*—North Carolina to Florida, west to Texas, June to September in the more northern parts of the range, March to November in Florida. Definite records are as follows:

ALABAMA: 1♂, Leroy, Washington County, June 11, 1917. Identified also from Mobile and Montgomery.

ARIZONA: 1♀, Florence, July 1903, (C. R. Biederman).

FLORIDA: 1♂, 2♀, Cutler, July 2, Aug. 24, and Nov. 2, 1927, (Graenicher). 1♂, Homestead, July 23, 1926, (Graenicher). 1♂, 3♀, Jacksonville Beach, Aug. 3–5, 1936, (Mitchell). 10♀, Miami, Apr. 8 to Nov. 2. 1♀, Sebring, Sept. 4, 1927. 4♀, West Palm Beach, Sept. 5 & 18, 1927; (all Graenicher).

3♂, 5♀, Miami, July 2–15 and Nov. 2, 1929 & 1930, (H. Heinrich). 3♀, Miami, Oct. 5–23, 1928 & 1934, (J. Pearson). 1♂, 1♀, Miami, June 15, 1931, (E. Miller). 1♂, Miami, Sept. 10, 1934, (C. A. Mosier). 1♀, Miami, Nov. 12, 1928, (H. Wolf). 1♀, Enterprise, May 15. 1♀, Coral Gables, Mar. 22, 1927, (J. Pearson). 1♀, Gainsville, Sept. 26–Oct. 2, 1914. 2♂, Titusville, Apr. 25, 1923. Identified also from Flamingo, Fort Myers, Lake Okeechobee, Royal Palm Park, and Thomasville.

Georgia: 2♂, 1♀, no locality record. 2♀, Brunswick, June 1, 1922, (Mitchell). 1♂, 1♀, Thalman, June 3, 1922, (Mitchell). 1♂, 2♀, Tifton, May 19, June 13 and June 21, 1896. Identified also from Waycross.

Louisiana: 1♀, Mansfield, July 4, 1906, (F. C. Bishop; on *Helianthus tenuifolium*).

Mexico: 3♂, no locality record. 1♂, Guadalajara, Aug. 28, 1903, (McLendon). 1♀, Lower California, (labelled *M. mexicana*).

New Mexico: 1♀, Albuquerque, June 27, 1931, 5000 ft., (H. A. Scullen).

North Carolina: 1♀, Beaufort, June 9, 1931, (on *Coreopsis*). 1♂, Burgaw, Sept. 10, 1928. 3♀, Castle Hayne, June 21, 1929, (on *Rudbeckia*). 1♂, Fort Fisher, June 22, 1929. 3♀, Horse Cove. Highlands, July 25, 1925, (on *Pycnanthemum*). 1♀, Lakeview, Sept. 25, 1933. 1♀, Marion, July 8, 1921. 1♂, 2♀, Raleigh, June 14, 1929, July 11, 1931 and Sept. 10, 1929. 3♀, Southport, June 24, 1928. 2♂, Swannanoa, Sept. 3, 1924, (on *Diodia teres*). 1♂, 2♀, Willard, June 22, 1929. 3♀, Wilmington, June 22 and Sept. 12 & 14; (all Mitchell).

Texas: 1♀, Bexar County, June 10, 1933 (Parks). 1♀, Fedor, Oct. 18, 1897, (Birkmann). 5♀, Galveston, May, (F. H. Snow). 1♀, Willis, June 5, 1903, (Bridwell). Identified also from Austin, Brazos County, El Paso, Fedor, Lee County, and Orange County.

Specimens of *albitarsis* have also been identified from Biloxi and Utica, Mississippi.

*Flower records.*—*Lespedeza repens, Galactia* sp., *Xyris caroliniana, Pycnanthemum hypsopifolia, Coreopsis* sp., *Rudbeckia hirta, Solidago* sp.

## Subgenus **MELANOSARUS** Mitchell

*Melanosarus* Mitchell, Trans. Am. Ent. Soc., LIX, p. 303, 1934.

*Melanosarus* is Neotropical for the most part, but is represented in North America by two species. The Neotropical species are listed in the reference cited above.

Tongue.—Second joint of labial palpus slightly shorter than the first; maxillary palpi very minutely pubescent, the third joint longer and more slender than the others.

*Female.*—Mandible 5-dentate, the two apical teeth approximate, and the three inner ones also approximate, a long cutting edge between the second and third; basal joint of flagellum usually slightly longer than pedicel, slightly shorter than the second joint; metatarsi robust, nearly as broad as the respective tibiae, and approaching them in length; claws in some species with short robust basal setae which are tooth-like in appearance; scutellum broadly triangular in shape, being somewhat pointed medially on the posterior margin; abdomen broadly cordate and rather flat, apical margins of the terga not at all depressed medially, but rather deeply depressed laterally, the sixth tergum triangular in dorsal aspect, the sides straight and the tip truncate, straight in profile, with no visible erect hairs; sixth sternum largely bare, with a dense short subapical fringe, beyond which is a short bare lip.

*Male.*—Mandible 4-dentate, inferior projection robust, subbasal; basal joint of flagellum subequal to or slightly longer than pedicel; the second joint usually considerably longer; cheeks densely pubescent below, more or less broadly concave, and with the inferior angle just beneath the base of the mandible produced into a short triangular spine; front coxa with a definite, though not extremely large, spine, and with a patch of red bristles on the relatively bare anterior face; mid tibia lacking the usual apical spur, usually more or less angulate on the inferior margin apically; front tarsi enormously dilated and highly modified; mid metatarsi long and slender, subequal in length to their tibiae; claws without distinct basal teeth; disc of sixth tergum vertical, the carina short, with a broad semicircular median emargination, apical margin of the tergum with at most very inconspicuous teeth; seventh tergum largely hidden between sixth tergum and fourth sternum.

Male sternites: Fourth sternum exposed; fifth presternite linear medially, with broad lateral portions, the medasternite broad and short, widely separated from the median portion of the presternite, the poststernal strip inevident; sixth presternite with well defined lateral portions, the medasternal areas rather indistinct, the poststernal lobe represented by a narrow median apical projection, more or less triangular.

Genital armature: Stipites robust, trilobate apically; sagittae relatively slender, shorter than stipites; volsellae robust.

GENOTYPE: *Megachile xylocopoides* Smith. [Orthotype.]

## *Key to Species of Melanosarus*

### Females

1. Wings very deeply infuscated, purplish; abdomen with numerous, rather large and deep punctures ........................ *xylocopoides* Smith
   Wings less deeply infuscated, not purplish to a marked degree, the hind wings nearly subhyaline; punctures of abdomen very minute and sparse ............................................ *floridensis* Mitchell

### Males

1. Front metatarsus very much larger than the second tarsal joint, which is rather short; mid and hind tarsi blackish ........*xylocopoides* Smith
   First and second joints of front tarsi more nearly equal in size, the second only slightly shorter than the first; mid and hind tarsi ferruginous ......................................*floridensis* Mitchell

**Megachile (Melanosarus) floridensis** Mitchell (Pl. VI.)

*Megachile* (*Melanosarus*) *floridensis* Mitchell, Trans. Am. Ent. Soc., LIX, p. 349, 1934.

The external characteristics of this species have already been described. The characteristics of the hidden male sternites and genital armature are as follows:

Male sternites: Lateral portions of presternite extensive, broader than long, median portion short linear, the medasternite closely covered with rather short and simple setae, its apical margin broadly and evenly outcurved; lateral portions of sixth presternite broader than long, the medasternal areas rather extensive, narrowed laterally, broadened toward the inner side, widely separated, covered with quite robust, elongate, flexed setae, the apical margin of the plate with a median triangular projection which may represent the poststernal lobe.

Genital armature: Stipites quite abruptly narrowed above base, not appreciably dilated toward the apex which is trilobate, the dorsal inner lobe expanded and curved apically, excavated between the dorsal and apical lobes, the ventral lobe robust, directed basally; sagittae slender, considerably shorter than stipites; volsellae robust, triangularly acute.

*Type.*—Male; Miami, Florida, June 10, 1927, (S. Graenicher, no. 140), [U. S. N. M., no. 44243].

*Range.*—Southern Florida. Since the publication of the description and list of paratypes, three additional females from Florida have come to hand, as follows: 1 ♀, Coral Gables, July 5, 1934, (Nelson). 1 ♀, Miami, Sept. 10, 1934, (C. A. Mosier). 1 ♀, Northwest Miami, July 15, 1934, (Mosier).

**Megachile (Melanosarus) xylocopoides** Smith (Pls. V and VI.)

*Megachile xylocopoides* Smith, Cat. Hym. Brit. Mus., I, p. 189, 1853. Friese, Das Tierr., Lfg. 28, Apidae I, p. 247, 1911. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

*Female.*—Size: Length 14–15 mm.; breadth of abdomen 5.5–6 mm.; anterior wing 11–12 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeal margin straight, the edge somewhat thickened and impunctate; mandible 5-dentate, a long cutting edge between the second and third teeth; basal joint of flagellum slightly longer than pedicel, very slightly shorter than the second; lateral ocelli much nearer each other than eyes, subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks slightly broader than eyes; metatarsi about equalling their tibiae in width, the hind metatarsi fully as long as their tibiae, the others slightly shorter than the respective tibiae; abdomen quite flat, apical margins of the terga not at all depressed medially and only slightly so at extreme sides.

Puncturation: Close and fine on sides of face, cheeks below and pleura above; irregular as to size and more sparse on clypeus; sparse on vertex where the punctures are of two distinct sizes; sparse in center of mesonotum and scutellum, closer laterally; relatively fine on abdomen, sparse on the first to fifth terga, very fine and close on the sixth.

Color: Black; antennae and tegulae somewhat more piceous than black; front wings deeply infuscated, violaceous, nervures piceous or black, hind wings paler; spurs dark ferruginous.

Pubescence: Very sparse above, more dense laterally and beneath, entirely deep black or fuscous, even to the lower surfaces of the tarsi, with no traces of fasciae; scopa entirely black.

*Male.*—Size: Length 10–13 mm.; breadth of abdomen 4–4.5 mm.; anterior wing 9–10 mm.

Structure: Face about as broad as long; eyes slightly converging below; clypeal margin slightly outcurved, otherwise entire; mandible 4-dentate, inferior projection subbasal, robust, broadly triangular; basal joint of flagellum subequal to pedicel, second joint slightly longer, the apical one broadly dilated and flattened; lateral ocelli slightly nearer each other than to eyes, and slightly nearer eyes than to edge of vertex; vertex flat; cheeks subequal to eyes in width; front coxae bare anteriorly with moderately long slender spines and a rather large patch of reddish bristles anterior to each spine near the base; inferior margin of front femur conspicuously carinate apically; front tarsi enormously dilated, the anterior margin of the metatarsus enlarged to form a deeply hollowed scale which projects apically to make the anterior margin of the joint fully twice the length of the posterior margin, second joint shorter but very broadly dilated, fully attaining the tip of the metatarsal scale, third joint less broadly dilated and the fourth not at all; mid metatarsi long and slender, fully as long as their tibiae, the latter angulate on lower margin apically; hind tarsi short; abdomen broad and rather flat, parallel-sided, fourth and fifth terga rather deeply depressed apically, the second and third with apical margins depressed only at extreme sides; carina of sixth tergum low, broadly emarginate medially, apical margin of the tergum devoid of evident teeth; seventh tergum evident only as a narrow rim along the margin of the sixth tergum.

Sternites: Lateral portions of fifth presternite quadrangular, the apical margin of each slightly angulate, the angle with four or five hairs, the median portion long linear, medasternite uniformly covered with fine and simple hairs, its apical margin broadly and conspicuously outcurved medially; lateral portions of sixth presternite longer than broad, apical margin of each oblique, with a limited area of fine pubescence, medasternal areas inconspicuous, indicated by a row of apical, medially flexed setae on each side of middle, these widely separated medially, the apical margin of the plate with a median triangular projection which may represent the poststernal lobe.

Genital armature: Stipites robust, slightly constricted above base, slightly dilated toward the apex, this with three conspicuous lobes, one directed apically, a longer one medially, and a still longer one ventrally and basally, this latter more robust and with a wing-like lateral expansion; sagittae relatively straight and slender, distinctly shorter than stipites; volsellae robust, triangularly acute apically.

Puncturation: Very minute and densely crowded on cheeks below, becoming relatively coarse and sparse above; moderately coarse and very close on pleura; rather coarse and irregularly scattered on vertex, about equally coarse but more close on mesonotum and scutellum, more widely separated in center of mesonotum; fine but distinctly separated on basal abdominal segment, becoming increasingly coarse and sparse to the fourth tergum, closer on the fifth, very fine and close on the sixth.

Color: Black; antennae piceous beneath; tegulae blackish; wings quite heavily infuscated, especially apically, the nervures piceous or black; mid and hind legs entirely black, as also front coxae and trochanters; front femur yellowish except for the ferruginous apical portion of the posterior face; outer face of front tibia piceous, the other two faces yellowish; front tarsi ivory-yellow, second joint with a black spot beneath which is margined with ferruginous; spurs yellowish.

Pubescence: Whitish or creamy on clypeus and face, cheeks below, front trochanters and femora, on scutellum, posterior face of propodeum, and basal abdominal segment; black or brownish-fuscous on vertex, mesonotum, pleura, mid and hind legs, and entire abdomen posterior to the basal segment, very thin on the abdomen dorsally, with no evident fasciae; front tarsal fringes white or creamy, brownish beneath, metatarsal scale fringed anteriorly with brownish or yellowish hairs; mid metatarsus with a rather definite but thin posterior fringe of fuscous hairs, these covering the outer face densely.

*Type.*—Female; United States, [Brit. Mus.].

*Range.*—Florida, along the coast to Maryland, and along the Gulf to Louisiana, March to September. Definite records are as follows:

FLORIDA: 4♀, no locality record. 1♂, 1♀, Haulover, March. 1♀, Indian River. 1♀, Melbourne, March, (P. Laurent). 5♂, 6♀, Miami, May 10, June 12, Sept. 11–23 and Nov. 8, (Graenicher). 1♀, Miami, Sept. 10, 1934, (C. Mosier). 1♂, Miami, (E. A. Wight). 2♂, Royal Palm Park, Apr. 12–18, 1923. Identified also from Enterprise, Fort Myers, Okeechobee, Paradise Key and St. Augustine.

GEORGIA: 2♂, 1♀, no locality record. 1♂, Tifton, May 16, 1896.

NORTH CAROLINA: 1♀, Hyde County, May 22, 1933. 1♂, 3♀, Wilmington, June 30, 1923, (on *Rudbeckia hirta*), July 10, 1922 and Sept. 12, 1928, (Mitchell).

Specimens of *xylocopoides* have also been identified from Alabama: Mobile; Louisiana; Maryland; and Mississippi–Biloxi.

*Flower records.—Rudbeckia hirta* and *Elephantopus carolinianus*. Graenicher also records this species at flowers of *Poinsettia cyathophora, Citrus limonum* and *Bidens leucantha,* in Florida.

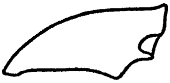
## EXPLANATION OF PLATES

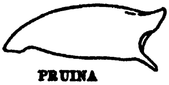
### PLATE V

Outlines of mandible in females and of front tarsus, mid tibia, mandible and apex of abdomen in males of *Argyropile, Leptorachis, Pseudocentron, Acentron* and *Melanosarus.*

### PLATE VI

Outline of fifth, sixth and eighth sternum and of genital armature in males of *Argyropile, Leptorachis, Pseudocentron, Acentron* and *Melanosarus.*


XYLOCOPOIDES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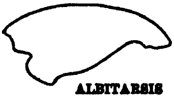
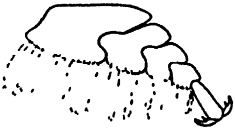

ALBITARSIS

MALE MID TIBIA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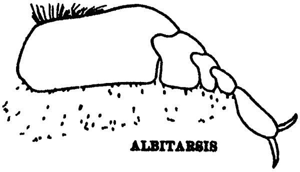
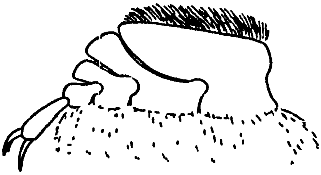
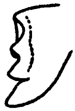

ALBITARSIS


XYLOCOPOIDES

MALE FRONT TARSUS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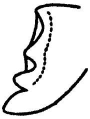
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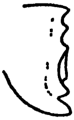
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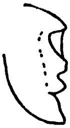
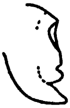
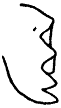
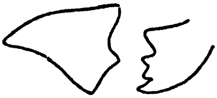
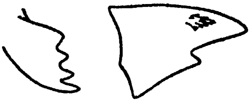

ALBITARSIS


PETULANS


PRUINA

FEMALE MANDIBLE


XYLOCOPOIDES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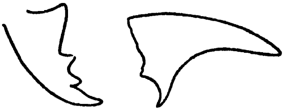
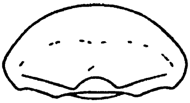
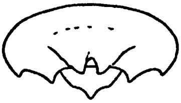
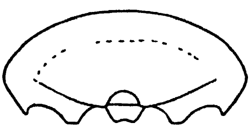

PARALLELA

MALE MANDIBLE

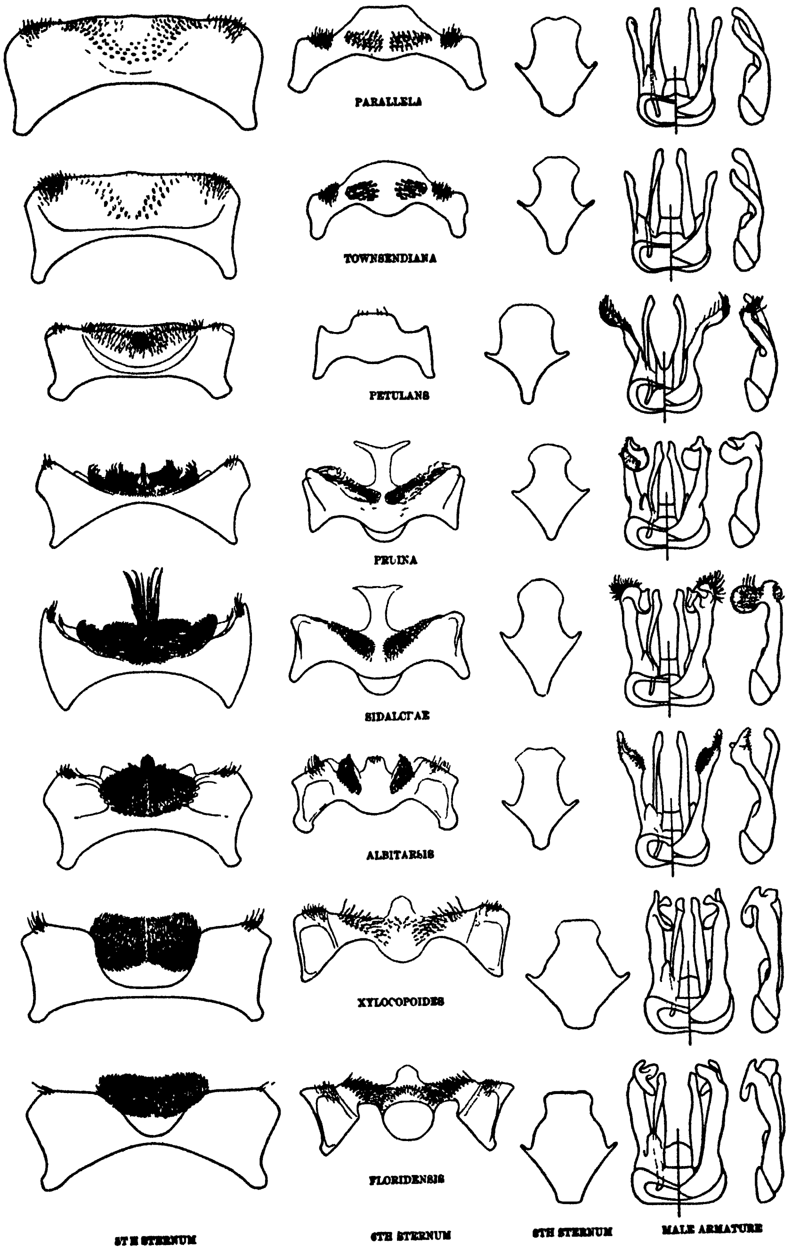

PETULANS


TOWNSENDIANA


PARALLELA

APEX OF MALE ABDOMEN

MITCHELL—NEARCTIC MEGACHILE



MITCHELL—NEARCTIC MEGACHILE

# ON TWO SPECIES OF PHASMIDAE FROM COLOMBIA WITH THE DESCRIPTION OF A NEW SPECIES

## (ORTHOPTERA)

BY JOHN W. H. REHN

(Plate VII)

This interesting material was collected, during a recent visit to Colombia, by Dr. J. Bequaert of the Harvard School of Tropical Medicine, and the following determinations were made at his request. The new species of *Pseudophasma* belongs to a rare and infrequently collected group of the genus.

**Autolyca bogotensis** (Goudot)

Bogotá, Department of Cundinamarca, Colombia; elevation 2600 meters; (J. Bequaert); 1 ♂, 1 ♀, ("under stones, mated"); [A.N.S.P.].

**Pseudophasma bequaerti** new species[1]

This striking insect is most closely related to *taeniatum*[2] Hebard and *robustum*[3] Hebard, being a member of the robust, brevialate group of this relatively large genus. The female, and only known sex, of *bequaerti* is immediately distinguishable from all the other known members of this genus by its very abbreviate wings which do not reach to the middle of the third abdominal segment (including median segment in the count). This species differs from *taeniatum* by lacking both a nodose occiput and lateral marginal mesonotal tubercles, and by having a longer mesonotum, this being half again as long as the pronotum. From

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[1] This interesting species is named for its collector, Dr. J. Bequaert, in appreciation of the broad biological and zoogeographic background evident in all of his entomological researches.

[2] *P. taeniatum* Hebard, Trans. Amer. Ent. Soc., XLV, p. 150, pl. 21, fig. 5. [♀; San Antonio, Cauca, Colombia.]

[3] *P. robustum* Hebard, Trans. Amer. Ent. Soc., XLV, p. 151, pl. 21, fig. 6. [♀; Cincinnati, Sierra Nevada de Santa Marta, Magdalena, Colombia.]

*robustum* the present form differs in having a large velvety discoidal area on the tegmen, the much more abbreviate wings, unicolorous limbs and differently annulate antennae.

TYPE.— ♀; Restrepo, Department of Meta, Colombia. Elevation 500 meters. August 12, 1936. (J. Bequaert; under log in dense moist forest). [Academy of Natural Sciences of Philadelphia, Type no. 5566].

Head a little longer than broad, smooth; ocelli present, paired ones slightly larger than anterior and slightly closer to each other than to anterior ocellus; compound eyes relatively large, globose. Antennae with light annulations on the bases of the fourth, sixth, eighth and tenth segments and thence to the apex the annulations are broader and more distantly spaced.

Pronotum relatively large, rather elongate, being one and one-third times as long as its greatest width, or equal to two-thirds the length of the mesonotum; surface smooth, cut by primary sulcus slightly before the middle. Propleura and prosternum as in the other members of the genus.

Mesonotum relatively long, one and one-third times the length of the pronotum and almost twice as long as its greatest width; lateral margins smooth; dorsum of anterior one-half of mesonotum laterad with a row of three or four low tubercles, between these rows and on the posterior one-half of mesonotum are numerous granules, some of which form sublinear groups. Mesosternum rounded, not carinate.

Ninth abdominal tergite with a slight medio-longitudinal keel which is distally expanded laterad, in profile but slightly elevated. Tenth tergite with a definite keel, distal margin of tergite shallowly concave, leaving the minute triangular supra-anal plate exposed. Cerci relatively short, stout, bluntly rounded. Operculum, in ventral aspect, with lateral margins very weakly convergent to distal fifth then obliquely convergent to the roundly angulate apex which is slightly distad of the cercal bases, the apex forming a right angle.

Anterior femur a little shorter than head and thorax together; basal flexure rather prominent, all margins rather weakly carinate: anterior tibia slightly longer than femur, its margins also weakly carinate: anterior tarsus as usual for the genus, with a rather large arolia. Median and posterior limbs much as anterior one, except, of course, lacking the basal flexure; median femur twice as long as the mesonotum; posterior femur slightly shorter than head and thorax together, almost the same length as anterior femur.

Tegmina reduced, quite short, slightly concave at discoidal margin, moderately compressed, somewhat depressed; discoidal area large, velvety, dorsal and marginal areas with the veins forming a prominent network. Wings reduced, not extending to the middle of the third abdominal segment.

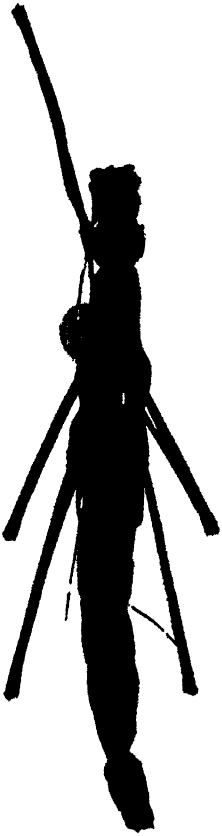
Length of body 50.5 mm.; length of dorsal surface of head 4.; length of pronotum 4.6; length of mesonotum 6.5; length of tegmen 5.; length of wings 9.5; length of anterior femur 17.; length of median femur 13.2; length of posterior femur 17.8; width of head 3.9; width of pronotum 3.4; width of mesonotum 4.; width of dorsal field of tegmen 2.8.

General coloration black or blackish brown. Head, thorax and limbs, except tarsi, black, abdomen blackish brown. Antennae blackish with pale buffy annulations. Tegmina black with veins buffy. Wings with anterior field blackish, veins corinthian purple, posterior field subtransparent, immaculate, pale ochraceous.

The type of this interesting species is unique.

## EXPLANATION OF PLATE VII

*Pseudophasma bequaerti* new species. Dorsal view of female type. × 1½.



REHN—NEW COLOMBIAN PHASMIDAE

# STUDIES IN THE PEMPHREDONINE WASPS

## (HYMENOPTERA: SPHECIDAE)

## I. New Genera and Species of the Ammoplanoid Complex

BY V. S. L. PATE

(Plates VIII and IX)

More than forty years have passed since Fox tabulated the North American species of the Pemphredonids.[1] Since that time, individual descriptions of many new species and even genera have been published, but save for Mickel's revision of *Xylocelia* [2] and Rohwer's treatment of the species of the typical subgenus of *Pemphredon*,[3] no work of a critical or comprehensive nature on the Nearctic forms of this group has appeared. During the past few years, quite a bit of material of this tribe has accumulated before me and it seems appropriate at this time to collect and attempt to coordinate in some measure this varied and scattered information.

The present paper is the first of a series designed to bring together and present in some systematic form these scattered taxonomic and distributional data with particular reference to the North American forms. It is primarily the result of at attempt to allocate our Nearctic species to the various groups proposed and defined several years ago by Gussakovskij in his revision of the Palæarctic species of *Ammoplanus* and related genera.[4] In this paper, Gussakovskij carefully characterized

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[1] Fox, Wm. J. The North American Pemphredonidae. *Trans. Amer. Ent. Soc.*, XIX, pp. 307–326, (1892).

[2] Mickel, C. E. A review of the American species of Xylocelia (Hymenoptera: Psenidae). *Ann. Ent. Soc. Amer.*, IX, pp. 344–352, (1916).

[3] Rohwer, S. A. The North American wasps of the subgenus Pemphredon Latreille. *Bull. Brooklyn Ent. Soc.*, XII, pp. 97–102, (1917).

[4] Gussakovskij, V. V. Revision der Gattungen *Ammoplanus* Giraud und einigen verwandten Sphegidengattungen. *Bol. Soc. Españ. Hist. Nat.*, XXXI, pp. 437–465, ill., (1931).

*Ammoplanus,* divided it into two distinct subgenera, *Ammoplanus* (*s. str.*) and *Ammoplanellus,* and proposed *Ammoplanops* for the reception of three new Transcaspian species. After studying the North American forms of this complex, it became at once apparent that none of the previously described species might be assigned to *Ammoplanus* as restricted by Gussakovskij, but that they must be placed either in *Ammoplanops* or a new group closely related to it. On the other hand, three undescribed species that may be allocated to *Ammoplanus* in the broad sense were unearthed in the collections of the Academy of Natural Sciences of Philadelphia, along with several more that belong to new genera. Descriptions of these new genera and species, as well as remarks pertaining to the previously described forms, will be found on the following pages.

As a result of a recently completed nomenclatorial survey of the genera of Sphecoid wasps,[5] a key to the genera and subgenera of the Pemphredonini is given herewith save for the Australian groups *Arpactophilus* Smith, *Austrostigmus* Turner, and *Paracrabro* Turner. Of these last three groups I have seen little material except for one or two species of *Arpactophilus.* Turner has been responsible for the definition and description of most of the Australian Pemphredonids,[6] but while his characterizations may be admirably adapted for the genera and species of that region, nevertheless they are too poorly designed to be properly fitted into a broad classification of the genera of the world without further study of the original material.

### *Key to Genera of Pemphredonini*[7]

1. Fore wings with one recurrent vein and two discoidal cells present; stigma large ........................................................2
   Fore wings with two recurrent veins and three discoidal cells present; stigma small or moderate sized ................................10

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[5] Pate, V. S. L. The generic names of the Sphecoid wasps and their type species. *Mem. Amer. Ent. Soc.*, no. 9, (1937).

[6] A revision of the Australian Pemphredonini will be found on pages 128 to 136 of the following paper: Turner, R. E. Notes on Fossorial Hymenoptera.—XIX. On new species from Australia. *Ann. & Mag. Nat. Hist.*, (8), XVII, pp. 116–136, (1916).

[7] Exclusive of the Australian forms *Arpactophilus* Smith, *Austrostigmus* Turner, and *Paracrabro* Turner.

2. Fore wings with no closed submarginal cells, both transverse cubital veins atrophied; (costal vein absent distad of stigma, the marginal cell open along the fore margin of the wing; mesopleura without episternauli; mesonotum without notauli anteriorly; females without a pygidium; Nearctic forms) ....................*Xysma* new genus

Fore wings with at least one closed submarginal cell and one transverse cubital vein present ..............................................3

3. Fore wings with one submarginal cell present; hind wings with the transverse cubital vein situated opposite or almost so the origin of the radial vein ..............................................4

Fore wings with two submarginal cells present; hind wings with the transverse cubital vein often situated beyond the origin of the radial vein ..............................................7

4. Abdomen petiolate; (Neotropical forms) ........*Microstigmus* Ducke

Abdomen sessile ..............................................5

5. Cubital vein of fore wing with a second abscissa subequal in length to the first; vertex produced above dorsal margins of the eyes for one-fourth or more their length; mesonotum without notauli anteriorly; mesopleura without episternauli; (Holarctic and Æthiopian forms) *Ammoplanus* Giraud

Cubital vein of the fore wing without a second abscissa, or if so this is much shorter than the first; vertex not extending much above the dorsal margin of the eyes; mesonotum with the notauli present anteriorly; mesopleura with the episternauli present ................6

6. Transverse cubital vein of fore wing distinctly augulate, upper ordinate vertical or almost so, lower ordinate sharply inclined, a stump or spur of a vein projecting distad at the angulation; mesonotum thrust forward over the pronotum; (Nearctic forms)...*Pulverro* new genus

Transverse cubital vein of fore wing straight, inclined, forming a more or less continuous oblique straight line with the radial and recurrent veins; mesonotum strongly arched anteriorly but not thrust forward over the pronotum; (Holarctic forms)...*Ammoplanops* Gussakovskij

7. Marginal cell of fore wing short, not longer than the stigma; radial vein not reaching the costal margin but recurrent and ending in the stigma..............................................8

Marginal cell of fore wing as long as, or longer than the stigma; radial vein always ending in the costal margin distinctly beyond the stigma; (second submarginal cell sessile or pointed on the radius)..........9

8. Second submarginal cell of fore wing sessile; pronotum narrow, elongate, one and one-half times as long as wide; propodeum elongate, longer than broad; abdomen subpetiolate, with a broad trigonal pygidium present in the males; (Transcaspian forms) *Anomiopteryx* Gussakovskij

Second submarginal cell of fore wing petiolate; pronotum short, transverse, much broader than long; propodeum short, much broader than long; abdomen sessile; (Mediterranean forms)..*Protostigmus* Turner

9. Abdomen distinctly petiolate; head in dorsal aspect subquadrate or transversely subrectangular; eyes converging toward the clypeus; mesopleura usually with a longitudinal horizontal furrow below; females with a distinct pygidium....................*Stigmus* Panzer

Subgenera of *Stigmus*

a. Temples well developed, strongly produced and angulate behind and below; (Neotropical forms) *Gonostigmus* Rohwer[8]

aa. Temples normal, not produced and angulate but tapering below; (Cosmopolitan forms)...............*Stigmus* Panzer

Abdomen sessile or subsessile; head in dorsal aspect transversely oval; inner margins of eyes subparallel or converging toward the vertex; mesopleura usually without a longitudinal horizontal furrow below; females without a pygidium; (Cosmopolitan forms)
*Spilomena* Shuckard[9]

10. Abdomen distinctly petiolate; mandibles with three to six teeth; labrum entire apically; episternal suture apparently vertical from below pronotal tubercles; females with a narrow, elongate, linear, subrectangular pygidium; hind tibiae with posterior margins simple, not spinose or subserrate; (Cosmopolitan forms)..*Pemphredon* Latreille

Subgenera of *Pemphredon*

a. Front usually armed medially just above antennal sockets with a large tubercle or horn; abdominal petiole short, not surpassing the hind coxae, only a little longer than high in lateral aspect; antennae short as in *Cemonus;* each submarginal cell of fore wing receiving a recurrent vein.
*Ceratophorus* Shuckard

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[8] Rohwer proposed *Gonostigmus* [1911, *Proc. U. S. Nat. Mus.*, XL, p. 559] for a unique female from Vera Cruz, Mexico which he named *G. typicus*. This may eventually prove to be a synonym of *Stigmus temporalis* Kohl [1892, *Ann. K. K. Naturhist. Hofmus., Wien*, VII, p. 204, pl. 13, figs. 31, 32] described from a male from Guatemala. After an examination of Rohwer's type in the United States National Museum and material of other undescribed species from Northern Mexico and Peru in the collection of the Academy of Natural Sciences of Philadelphia and elsewhere, I have come to the conclusion that *Gonostigmus* should be accorded no more than subgeneric rank inasmuch as it agrees with the typical *Stigmi* in all essential features save for the character of the temporal region of the head.

[9] Prof. T. D. A. Cockerell [*in litt.*] has called my attention to the Australian genus *Microglossa* [1930, *Proc. R. Soc. Victoria,* (N.S.), XLII, p. 212] described by Rayment as a bee and which, since it was a homonym, Rayment recently changed to *Microglossella* [1935, *A Cluster of Bees,* pp. 16 & 634], and inquired if it might not be identical with *Spilomena*. An examination of Rayment's descriptions and excellent figures has convinced me that Professor Cockerell's conjecture is indubitably correct. *Microglossa* Rayment, 1930 *nec* Fauvel, 1865 *nec* Mulsant & Rey, 1874 and *Microglossella* Rayment, 1935 should be recorded as synonyms of *Spilomena* Shuckard, 1838. Recently, Turner [1936, *Ann. & Mag. Nat. Hist.,* (10), XVIII, p. 533] has likewise come to the same conclusion.

Front unarmed; abdominal petiole surpassing the hind coxae, at least twice as long as high in lateral aspect..............b

b. Each submarginal cell of fore wing receiving a recurrent vein, or occasionally the second recurrent vein interstitial with the first transverse cubital vein; antennae long, first flagellar article about three times as long as wide at apex, antennae of male reaching almost to scutellum or postscutellum. *Pemphredon* Latreille

First submarginal cell receiving both recurrent veins, or the second recurrent vein often interstitial with the first transverse cubital vein; antennae shorter, first flagellar article at most only twice as long as wide at apex, antennae of male reaching at most only to tegulae.........*Cemonus* Panzer[10]

Abdomen sessile or subsessile, if apparently petiolate then without such combination of characters..................................11

11. Labrum with apex entire, roundly pointed; neither sex with a pygidial area; hind tibiae with posterior margins simple, unarmed, occasionally (*Polemistus*) with a small spiniferous tubercle; (Cosmopolitan forms) .....................................*Passaloecus* Shuckard[11]

Labrum with apex emarginate; both sexes with a subtrigonal pygidium; hind tibiae with posterior margins spinose or subserrate; (Cosmopolitan forms).................................*Xylocelia* Rohwer[12]

The genera of the Ammoplanoid complex by reason of their minute size and greatly reduced wing venation vie with the Oxybelines for the distinction of being the most specialized group of the Sphecoid wasps. They may be distinguished from the other Pemphredonines by the fact that they possess but one closed submarginal cell at most in the fore wing and have the transverse cubital vein of the hind wing situated opposite, or almost so, the origin of the radial vein. These criteria, however, while convenient, nevertheless may be somewhat artificial since there is presumptive evidence that *Ammoplanops* and a closely related new genus described here have been derived from the stock of *Xylocelia,* whereas *Ammoplanus* and its more closely related groups may have had their origin in a Spilomenoid ancestor.

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[10] This is the group which in recent years has been known under the names *Dineurus* Westwood, 1837 or *Diphlebus* Westwood, 1840. A full discussion of the tangled nomenclatorial history of these names, all of which are isogenotypic, will be found in my paper on the generic names of the Sphecoid wasps [1937, *Mem. Amer. Ent. Soc.*, no. 9] under *Cemonus* Panzer, 1806 in Appendix I, and *Pemphredon* Latreille, 1796 in Appendix II.

[11] At present, I am of the opinion that *Passaloecus* may be divided into three subgenera as follows: *Passaloecus* (*s. str.*), *Coeloecus* Verhoeff, 1890. and *Polemistus* Saussure, 1892 but I regard my data still too incomplete to venture giving a key to them at this point.

[12] Olim *Diodontus* Auoct., *nec* Curtis, 1834. *Diodontus* Curtis, 1834 must be used for the Psenine groups which have hitherto usually been known as *Neofoxia* Viereck, 1901 and *Psenulus* Kohl, 1896.

Under each of the following genera and subgenera I have endeavoured to give some generalizations on its distribution. These data, however, must be regarded as largely tentative and merely a mirror of our existing knowledge of the group. Due to their extremely small size, these minute forms are easily overlooked by the ordinary collector and consequently as more material is acquired it will probably be necessary to modify, considerably in some cases, our views on the distribution of the various genera and species.

### XYSMA[18] new genus

(Fig. 17)

1904. *Ammoplanus* Viereck (in part) [*nec* Giraud], Psyche, xi, p. 72.

Head subquadrate in anterior aspect, transversely oval in dorsal aspect; eyes truncate below, reaching to bases of mandibles, inner orbits parallel to subparallel, coarsely facetted anteriorly, finely facetted posteriorly; vertex subquadrately arched and subtruncate posteriorly, extending above dorsal margins of eyes for a distance of about one-fourth their length; ocelli arranged in a subequilateral triangle, the median ocellus about on a line with the dorsal margins of eyes; temples moderately wide above, tapering ventrad. Clypeus narrow, linear, transverse. Antennae simple, situated very low on face just above dorsal margin of clypeus, about twice as far from each other as from the nearest eye margin. Mandibles simple, unarmed beneath, bidentate apically. Maxillary palpi six-, labial palpi four-segmented.

Thorax with the pronotum short, transverse, narrower than mesonotum, transversely carinate anteriorly, situated below the level of the mesonotum, the tubercles attaining the tegulae or almost so; mesonotum strongly arched anteriorly where it is rounded and ventrically declivous to level of pronotum but not thrust forward or overhanging the latter, anterior margin evenly arcuate in dorsal aspect, notauli absent anteriorly; mesopleura with the episternal suture short, somewhat indistinct, descending vertically from below the tubercles, episternauli absent; propodeum flat above, truncate behind. Legs with the fore femora semilunate, the upper margin straight, lower margin evenly arcuate; middle and hind femora subfusiform; middle and hind tibiae somewhat thickened apically, the middle pair furnished with one apical calcar, hind tibiae with two; females without a tarsal comb on fore tarsi.

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[18] From *ξύσμα, τό,* a small particle, in allusion to the extremely small size of its genotypic and sole included species.

Wings: fore wings with the stigma large, twice as long as its greatest breadth, costal vein absent distad of stigma; marginal cell elongate lanceolate, open along costal margin; all transverse cubital veins wanting, hence no closed submarginal cells. Hind wings with the transverse cubital vein situated somewhat beyond the origin of the radial vein so that the median cell is somewhat obliquely produced at apex. Venation otherwise as in *Spilomena*.

Abdomen sessile, fusiform, not depressed. Females without a pygidium, the last two segments compressed.

GENOTYPE: *Ammoplanus ceanothae* Viereck.

This genus, based upon the lectotype of *Ammoplanus ceanothae* Viereck, belongs to the *Spilomena*-*Ammoplanus* group of the Ammoplanoid complex and represents a link somewhat intermediate between the two. The general habitus of the body is suggestive of *Ammoplanus* but the episternal suture of the mesopleura descends from below the pronotal tubercles and the marginal cell of the fore wing is elongate and lanceolate as in *Spilomena* to which it apparently bears much the same relation as *Ammoplanellus* does to *Ammoplanus* through the costal vein being absent distad of the stigma. From both *Ammoplanus* and *Spilomena* it differs principally by the loss of all the transverse cubital veins thus causing the fore wing to be without any closed submarginal cells. This character was thought at first to be merely a venational abnormality but several years ago, shortly after I had discovered the type series of Viereck's *Ammoplanus ceanothae* in the Academy of Natural Sciences of Philadelphia, I had an opportunity to examine in the United States National Museum a series of specimens taken in northern Virginia near Washington.[14] All of them possessed the same type of fore wing and consequently I believe that this character may be regarded as normal, not teratologic for the group.

*Nomenclatorial history*.—In 1904, Viereck described *Ammoplanus ceanothae* from a series of six specimens taken over a period of several years at Lehigh Gap, Northampton County, Pennsylvania, stating that the type had been deposited in the Academy of Natural Sciences of Philadelphia. No such species, however, was reported in the list of Hymenoptera types[15] published in 1928. Consequently several years ago I instituted a search of their collection of Hymenoptera and found, in a Schmidt box at the end of the series of Hymenoptera types in the rooms of the American Entomological Society, a series of six carefully preserved specimens with red type labels bearing the notation "*Ammoplanus lehighensis*" printed in Viereck's own hand. Beside these, and on the page of the Society's copy of the volume of Psyche whereon Viereck proposed *Ammoplanus ceanothae*, was a query by the late Mr. E. T. Cresson. Careful comparison of the data associated with the specimens labelled "*Ammoplanus lehighensis*" with Viereck's description of *Ammoplanus ceanothae* leaves no doubt in my mind that these represent the original type series from which Viereck described his species. In the interval of several years elapsing between 1901 when the last specimen of the series was caught, and 1904 when he finally published the description of this species, Viereck apparently decided to change the name—a not uncommon practice with many systematists—from "*lehighensis*" to *ceanothae*, probably deeming the latter name a more suitable one inasmuch as some of the later material had been taken at the flowers of New Jersey tea, *Ceanothus americanus*. It is unfortunate that he forgot to change the name on the specimens.

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[14] When I visited the United States National Museum a year later, I could no longer find these specimens from Virginia which may be a new species.

A study of this type series has revealed that it is a heterogeneous one, and that Viereck's description is a composite. Since he did not specify any particular specimen of the series as holotype in his original description, I have chosen as lectotype of *Ammoplanus ceanothae* the specimen labelled by Viereck as "*Ammoplanus lehighensis*, Holotype." This specimen, however, is not a true *Ammoplanus*, but the type of the present new genus, whereas of the five specimens labelled "*Ammoplanus lehighensis*,

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[15] Cresson, E. T. The Types of Hymenoptera in the Academy of Natural Sciences of Philadelphia other than those of Ezra T. Cresson. *Mem. Amer. Ent. Soc.*, no. 5, 90 pp. (1928.)

Paratype ", three represent the first species of true *Ammoplanus* to be reported from North America, while the remaining two are a new eastern species of the subgenus *Ammoplanellus*. Descriptions of both of these will be found on a following page in their respective place while a redescription of the lectotype is given below.

*Distribution.* — Nearctic. From east-central Pennsylvania (Northampton County) southward to northern Virginia (Fairfax County?).

**Xysma ceanothae** (Viereck) (Figs. 17, 19)

1904. *Ammoplanus ceanothae* Viereck [in part], Psyche, XI, p. 72.

*Female.*—2.5 mm. long. Black; head very dark castaneous; mandibles except apices which are red, antennae, the flagellum infuscated apically, and tegulae, pale fulvous. Fore legs deep yellow to light fulvous; middle tibiae with a basal and apical fulvous ring; hind tibiae, middle and hind tarsi light fulvous. Wings clear hyaline, veins light stramineous, stigma save for stramineous base, light fuscous.

Head glabrous, shining, subquadrate in anterior aspect; face minutely, weakly, longitudinally, interruptedly subaciculate; eyes truncate below, reaching to bases of mandibles, inner orbits subparallel; vertex subquadrately produced above dorsal margins of eyes for about one-fourth their length; ocelli in a low equilateral triangle, median ocellus on a line with dorsal margins of eyes. Antennae situated very low on face, on dorsal margin of clypeus, about one and one-half times as far from each other as from nearest eye margin; scapes about one-half as long as length of eyes, slightly bowed; flagellum finely puberulent, about twice as long as scape. Clypeus nitidous, very narrow, transversely, semilunately linear, apical margin with a row of short ammochaetae and subtruncate medially, discally strongly and longitudinally arched to between antennal sockets, the inflation passing gradually into a very low, inconspicuous, weak median longitudinal keel on front which continues dorsad for about half the length of eyes. Mandibles narrow, sublinear, entire and without a tooth beneath, bidentate apically; lower margin furnished with a few short ammochaetae.

Thorax shining, glabrous; pronotum narrow, transverse, situated below the level of mesonotum, with an apparent dorsal surface, anteriorly weakly transversely carinate, tubercles practically attaining the tegulae. Mesonotum fine and minutely, transversely subcoriaceo-reticulate, the sculpture weaker discally, arched anteriorly but not thrust forward over pronotum, notauli absent; mesopleura with a weak suture descending vertically from below the tubercles, episternauli absent. Propodeum glabrous, shining to semiopaque; dorsal surface with two parallel longitudinal carinulae discally, laterad of which the surface is transversely substriate; posterior face shining, highly polished, practically without sculpture, medially with a very weak longitudinal sulcus, lateral and dorsal margins edged by weak carinulae; lateral faces shining, highly polished, and practically without sculpturing.

Abdomen shining, highly polished, impunctate, with scattered, inconspicuous puberulent pubescence, most noticeable on posterior segments; tergites and sternites imbricated; pygidium absent, last two segments compressed.

*Male*.—Unknown.

*Lectotype*.—♀; Lehigh Gap, Northampton County, Pennsylvania; July 11, 1900; (Henry L. Viereck); [Academy of Natural Sciences of Philadelphia, Type no. 10210].

As explained above under the remarks on the nomenclatorial history of this genus, I have chosen as lectotype the specimen labelled by Viereck as "*Ammoplanus lehighensis*, Holotype." Inasmuch as Viereck's original description of *Ammoplanus ceanothae* was a composite one gleaned from a superficial study of a heterogeneous series, I have redescribed the species after a study and examination of the type.

## AMMOPLANUS Giraud

1869. *Ammoplanus* Giraud, Ann. Soc. Ent. France, (4), IX, p. 469.
1886. *Hoplocrabron* De Stefani, Natural. Sicil., IV, p. 60.
1890. *Ammoplanus* Kohl (in part), Ann. K. K. Naturhist. Hofmus., Wien, V, p. 61.
1904. *Ammoplanus* Viereck (in part), Psyche, XI, p. 72.
1931. *Ammoplanus* Gussakovskij, Bol. Soc. Españ. Hist. Nat., XXXI, p. 438.
1931. *Ammoplanellus* Gussakovskij, Bol. Soc. Españ. Hist. Nat., XXXI, p. 442. [Subgenus.]

GENOTYPE: *Ammoplanus Perrisi* Giraud, 1869.

This genus, the oldest one of the complex, has been carefully defined by Gussakovskij in his recent revision of the Palæarctic species of *Ammoplanus* and related genera to which the student is referred for an able characterization of the genus and the European species. Both *Ammoplanus* and *Xysma* have apparently been derived from the ancestral stock of *Spilomena* with which they agree in the facies of the head, the structure of the mesopleura and the fore wings, and the general habitus of the abdomen. The chief characters differentiating these from *Spilo-*

*mena*, as well as from each other, will be found in the key to genera on a preceding page.

*Remarks.*—Gussakovskij divided the genus *Ammoplanus* into two subgenera, both of which are present in North America. In the typical subgenus of *Ammoplanus*, as defined by Gussakovskij, the radial vein of the fore wing attains the costal margin of the wing and the females possess a distinct pygidium, whereas in *Ammoplanellus* the radial vein does not reach the costal margin of the fore wing and the females lack a pygidium. Careful examination of material from Europe, North America, and South Africa of each of these groups has revealed an additional character for separating these two. In the fore wing of *Ammoplanus* in the strict sense, the costal vein is present distad of the stigma so that the marginal cell is fully closed, whereas in *Ammoplanellus* the costal vein is absent distad of the stigma, the marginal cell in this case being open along the fore margin of the wing. In his paper, Gussakovskij has called attention to and described somewhat cursorily, but unfortunately not figured the modifications of the apical abdominal sternites of the males of this genus. The North American males of both *Ammoplanus* and *Ammoplanellus* have the fifth to last sternites characteristically modified for each species, but I have seen as yet too little extralimital material to venture giving at this point any additional subgeneric characters for the males based upon this detail, although such will without doubt eventually be found. When this fact has been satisfactorily settled, it may be advisable to accord *Ammoplanellus* generic rank as Gussakovskij has suggested. For the time being, however, I prefer to regard it merely as a subgenus of *Ammoplanus*.

*Distribution.*—Holarctic and Æthiopian regions. Interrupted in the Nearctic region, one species being found in the sonoran zone of southern New Mexico, and two in east-central Pennsylvania. Widespread and generally distributed throughout the Mediterranean region of Europe and northern Africa, ranging eastward into the Transcaspian region of central Asia. In the Æthiopian region, represented by three species from South Africa and one from Madagascar.

*Nearctic components.*—Although all authors, practically without exception, have placed the various Nearctic species of the Ammoplanoid complex in the present genus, none of those previously described may be allocated to *Ammoplanus* according to our present modern concept of the group. The three species described on the following pages, therefore, represent the first North American forms that may be properly assigned to this group. Of these, the two that are described from east-central Pennsylvania originally formed part of the type series upon which Viereck based *Ammoplanus ceanothae.* A full discussion of this will be found under the account of the nomenclatoral history of the genus *Xysma.* Three of Viereck's paratypes of *Ammoplanus ceanothae* form the first species of true *Ammoplanus* to be reported from North America, while the remaining two are an eastern species of the subgenus *Ammoplanellus.*

*Ethology.*—Very little is known as yet concerning the biology of these small wasps. In South Africa, Arnold has recorded *Ammoplanus* (*Ammoplanellus*) *consobrinus* nesting in a decayed wooden post at Helenvale, Southern Rhodesia, and *Ammoplanus* (*Ammoplanellus*) *rhodesianus* nesting in a sandy bank at Sawmills, and in the cracks of an old mud wall at Bulowayo. Inasmuch as the females possess neither a distinct tarsal comb on the fore tarsi, nor a psammophore, it does not seem likely that they excavate a nest themselves but merely utilize pre-existing holes or crannies in wood, old walls, or the soil. The adults frequent flowers, often in great numbers; Gussakovskij records them from *Tamarix* in Europe, while Viereck has taken them on the flowers of New Jersey tea, *Ceanothus americanus,* in east-central Pennsylvania.

### *Key to Subgenera of Ammoplanus*

**Fore wing with the radial vein reaching the costal margin and with the costal vein present distad of stigma so that the marginal cell is closed; females with a distinct pygidium..................*Ammoplanus* Giraud**

**Fore wing with the radial vein not reaching the costal margin and with the costal vein absent distad of stigma so that the marginal cell is open; females without a pygidium...............*Ammoplanellus* Gussakovskij**

### Subgenus AMMOPLANUS Giraud

1869. *Ammoplanus* Giraud, Ann. Soc. Ent. France, (4), IX, p. 469. [Genus.]
1931. *Ammoplanus* Gussakovskij, Bol. Soc. Españ. Hist. Nat., XXXI, p. 442. [Subgenus.]

GENOTYPE: *Ammoplanus Perrisi* Giraud, 1869.

This group is understood here in the sense in which it was restricted by Gussakovskij in his revision of the Palaearctic species of *Ammoplanus*. As pointed out on a preceding page, in addition to the characters given by Gussakovskij, the costal vein of the fore wing is present distad of the stigma to the point where the radial vein reaches the costal margin of the wing so that the marginal cell is completely closed.

*Distribution.*—Widely interrupted. One species, described below from east-central Pennsylvania, present in the Nearctic region. Thirteen species known at present from the old world, of which twelve are Palaearctic in distribution, and one from the Aethiopian region.[16]

**Ammoplanus (Ammoplanus) unami**[17] new species (Figs. 2, 14)

1904. *Ammoplanus ceanothae* Viereck (in part), Psyche, XI, p. 72.

This, the first and only species of true *Ammoplanus* known as yet from North America, is described from three paratypes of the heterogeneous series upon which Viereck based his *Ammoplanus ceanothae*. It closely resembles the European *A.* (*Ammoplanus*) *Perrisi* Giraud but differs from it in the form of the clypeus, the sculpturing of the propodeum, and the relative length of the flagellar articles.

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[16] Only one Aethiopian species is known that at present may be assigned to the typical subgenus of *Ammoplanus:*

**Ammoplanus (Ammoplanus) mandibularis** Cameron

1908. *Ammoplanus mandibularis* Cameron, Entomologist, XXXVI, p. 178. [♀; Pearston, C. P., South Africa.]
1923. *Ammoplanus capensis* Arnold, Ann. Transvaal Mus., X, p. 58, fig. 83. [♀; Willowmore, C. P., South Africa.]
1927. *Ammoplanus mandibularis* Arnold, Ann. Transvaal Mus., XII, p. 118.

[17] From the Unami, a clan of the Lenni Lenape Indians, who formerly inhabited eastern Pennsylvania from the Lehigh River southward.

*Female.*—2.5 mm. long. Black; mandibles except extreme apices which are red, labrum, scape and pedicel, yellow; flagellum fulvous becoming fuscous apically; head capsule except ocellar triangle, thorax especially pleura, and propodeum with a tendency toward becoming dark castaneous; tarsi fulvescent. Wings clear hyaline, veins stramineous, stigma except for stramineous base, light fulvous.

Head glabrous, shining, minutely, longitudinally coriaceo-reticulate; eyes truncate below, reaching to bases of mandibles, inner orbits shallowly arcuate and with a tendency to converge toward clypeus; vertex subquadrately produced above dorsal margins of eyes for about half their length; ocelli in a low equilateral triangle, the median ocellus situated about one-third the length of eyes above their dorsal margins. Antennae short, reaching about to tegulae, situated low on face just above dorsal margin of clypeus, about twice as far from each other as from nearest eye margin; scapes somewhat bowed, a little more than half the length of eyes; flagellum finely puberulent, two to two and one-half times as long as scape. Clypeus nitidous, narrow, length laterally about one-ninth the length of eyes, widening mesad to about two-ninths, transverse, medially subtrapezoidally excised almost to antennal sockets, lateral edges of emargination arcuately divergent, upper excised margin medially obtuse angled ventrad, width of excision at base about one-third length of eyes, lateral areas of clypeus evenly arcuate distally. Labrum subquadrate, filling the clypeal excision, deeply emarginate medio-apically, lateral lobes roundly pointed. Mandibles narrow, sublinear, internally with a long oblique shoulder from just before apex almost to base. Front medially with a very low indistinct longitudinal keel running dorsad for about two-thirds the length of eyes from upper margin of clypeus. Vertex and occiput shining, impunctate.

Thorax with an inconspicuous short pubescence on pronotum, mesonotum, scutellum and postscutellum; mesosternum more heavily clothed with appressed silvery pubescence. Pronotum narrow, transverse, rounded and gradually declivous anteriorly to neck, situated below level of mesonotum and only about one-half as wide as it, the tubercles almost attaining the tegulae. Mesonotum shining to semiopaque, sculptured somewhat similarly to face but transversely so, gradually and arcuately declivous to level of pronotum, the posterior dorsal surface of which it tends to slightly overhang, anteriorly without notauli; scutellum and postscutellum shining, sculptured like mesonotum; mesopleura glabrous, shining, longitudinally semi-aciculate, episternal suture distinct, apparently vertical from below anterior wing bases, episternauli absent. Propodeum shining, glabrous, dorsal surface subgranulate, with weak inconspicuous, irregular reticulations, posterior face with a weak median longitudinal sulcus, lateral faces obliquely aciculate. Legs clothed with fine appressed pubescence, tibiae somewhat incrassate apically, fore tarsi without a comb, hind tarsi simple, terete.

**Abdomen** fusiform, shining, highly polished, impunctate, not constricted between the segments, first three tergites glabrous, remaining tergites and sternites sparsely clothed with short decumbent, silvery or aeneous pubescence; pygidium broad, subtrigonal, the apex broadly rounded to subtruncate.

*Male.*—Unknown.

*Type.*— ♀ ; Lehigh Gap, Northampton County, Pennsylvania; July 11, 1900; (Henry L. Viereck); [Academy of Natural Sciences of Philadelphia, Type no. 4174].

*Paratypes.* — 2 ♀ ; topotypical, July 12, 1900, (Henry L. Viereck), [A.N.S.P.].

## Subgenus AMMOPLANELLUS Gussakovskij

(Fig. 13)

1931. *Ammoplanellus* Gussakovskij, Bol. Soc. Españ. Hist. Nat., xxxi, p. 442.

GENOTYPE: *Ammoplanus* (*Ammoplanellus*) *chorasmius* Gussakovskij. (By monotypy and original designation.)

Gussakovskij proposed *Ammoplanellus* as a subgenus of *Ammoplanus*, basing it upon a series of three females from Chorasmia in Transcaspia. Until the present time, the males of *Ammoplanellus* have apparently remained unknown. The Nearctic forms of this group before me, however, are represented only by males. Save for the venation of the fore wing, they possess no character that will serve to differentiate them collectively from the typical *Ammoplani*. Like the latter group, they have the fifth to last abdominal sternites peculiarly modified, but as I have indicated on a preceding page, I have not as yet had an opportunity to study sufficient exotic material of the males of both subgenera to draw any conclusions as to whether the structure of these sternites will offer additional characters substantiating the venation of the fore wing. Consequently, I have followed Gussakovskij in retaining *Ammoplanellus* as a subgenus of *Ammoplanus*.

*Distribution.* — Discontinuous. Represented in the Nearctic region by two species described below, one from east-central Pennsylvania, the other from southern New Mexico. One species, the type of the group, is found in Transcaspia in the Palaearctic region, while the Aethiopian region has three,[18] two from Southern Rhodesia and one from Madagascar.

### *Key to Nearctic Species of Subgenus Ammoplanellus*[19]

Labrum subquadrate, deeply emarginate medio-apically; lateral faces of propodeum longitudinally striate or wrinkled; (Pennsylvania). *lenape* new species

Labrum transversely subrectangular, retuse medio-apically at most; lateral faces of propodeum obliquely striate; (New Mexico)..*apache* new species

**Ammoplanus (Ammoplanellus) lenape**[20] new species (Figs. 5, 13)

1904. *Ammoplanus ceanothae* Viereck (in part), Psyche, XI, p. 72.

This species is described from two males which originally formed part of the heterogeneous series upon which Viereck based *Ammoplanus ceanothae.* A full discussion of this point will be found under the treatment of the nomenclatorial history of the genus *Xysma* on a preceding page.

The present species, apparently confined to the east-central portion of Pennsylvania so far as known at present, is well differentiated from its southwestern relative by the structure of the clypeus, labrum, apical abdominal sternites of the males and the sculpturing of the propodeum.

*Male.*—2.5 mm. long. Black: mandibles, except the apices which are red, palpi, labrum, and clypeus, light yellow; antennae brownish-yellow; tip of abdomen ventrally very light fulvous; anterior tibiae, all tarsi, tegulae, and axillary sclerites, fusco-fulvous. Wings clear hyaline with iridescent reflections, veins stramineous, stigma castaneous except for stramineous base.

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[18] The following three Aethiopian species may be allocated to *Ammoplanellus:*

**Ammoplanus (Ammoplanellus) consobrinus** Arnold

1927. *Ammoplanus consobrinus* Arnold, Ann. Transvaal Mus., XII, p. 118, fig. 35. [♀, ♂; Helenvale, Southern Rhodesia; nesting in a decayed wooden post.]

**Ammoplanus (Ammoplanellus) madecassus** Kohl

1909. *Ammoplanus madecassus* Kohl, [in Voeltzkow], Reise in Ostafrika in den Jahren 1903–1905, II, p. 374, fig. 9. [♀; Tulear, south west Madagascar.]

**Ammoplanus (Ammoplanellus) rhodesianus** Arnold

1924. *Ammoplanus rhodesianus* Arnold, Ann. Transvaal Mus., XI, p. 41, fig. 31. [♀, ♂; Southern Rhodesia: Sawmills, nesting in a sandy bank; Bulawayo, nesting in cracks of an old mud wall.]

[19] Based upon the males; no females are as yet known from North America.

[20] After the Lenni-Lenape, a tribe of Indians formerly inhabiting eastern Pennsylvania.

Head glabrous, shining, finely alutaceous; eyes truncate below, reaching to the bases of the mandibles, inner orbits shallowly arcuate; vertex subquadrately produced above dorsal margins of the eyes for about half their length; ocelli in a low equilateral triangle, median ocellus situated about one-fourth the length of eyes above their dorsal margins. Antennae long, reaching beyond the tegulae, situated on dorsal margin of clypeus about one-fourth the length of the eyes from each other, the antennocular line slightly longer than the interantennal line; scapes somewhat bowed, about five-eighths the length of eyes; flagellum finely puberulent, almost three times the length of scape. Clypeus nitidous, narrow, about one-eighth the length of eye, transverse, medially quadrately excised almost to bases of the antennae, the excision as wide as the distance from outer margin of one antennal socket to the other, i.e., about one-half the length of the eye, laterodistal angles of excision bluntly dentate, lateral lobes of clypeus truncate distally. Labrum quadrate, filling the clypeal excision, deeply emarginate medio-apically, lateral lobes roundly pointed. Mandibles narrow, linear, unidentate apically, obliquely shouldered internally just before the apex. Vertex and occiput shining, impunctate.

Thorax with an inconspicuous, fine appressed pubescence on mesonotum; mesosternum more heavily clothed with fine appressed silvery pubescence; pleura and propodeum shining and glabrous. Pronotum narrow, transverse, rounded and gradually declivous anteriorly to neck, situated below level of mesonotum and only about one-half as wide as it, the tubercles almost attaining the tegulae. Mesonotum shining, with fine distinctly separated punctures, gradually and roundly declivous anteriorly to level of pronotum, anteriorly without impressions; scutellum shining, punctured like mesonotum, anteriorly more sparsely than posteriorly; postscutellum shining, impunctate; pleura shining, finely alutaceous to semistriate, episternal suture distinct, vertical from below anterior wing bases. Propodeum shining, dorsally with a median longitudinal carinula laterad of which the surface is minutely granulate to wrinkled or alutaceous, posterior face with a median elongate trigonal fovea dorsally, laterad of which the surface is weakly semistriate, lateral faces minutely wrinkled and weakly longitudinally striate. Legs clothed with fine appressed silvery pubescence; femora fusiform; tibiae somewhat incrassate apically; hind metatarsi simple, terete.

Abdomen oval, somewhat depressed, shining, highly polished and impunctate; the tergites glabrous or nearly so, folded under roundly to the venter and imbricate there with the sternites; first four sternites glabrous and simple, remainder pubescent, fifth sternite with apical margin bisinuate and hirsute, medio-apically with a pair of small hirsute, caudally-produced tubercles, sixth sternite with a low weak median longitudinal keel, very obtuse angulate apically, medio-apically mucronate, apical margin hirsute, seventh sternite elongate, narrow and somewhat constricted basally, spatulate apically and with a broad rounded emargination there, eighth sternite spatulate and strongly hirsute apically.

*Female.*—Unknown.

*Type.*—♂; Lehigh Gap, Northampton County, Pennsylvania; July 17, 1899; (Henry L. Viereck); [Academy of Natural Sciences of Philadelphia, Type no. 4172].

*Paratype.*—♂; topotypic, June 29, 1901, (Henry L. Viereck; on flowers of *Ceanothus americanus*), [A.N.S.P.].

**Ammoplanus (Ammoplanellus) apache**[21] new species (Fig. 8)

This species, which is probably much more widespread in the southwest than the types would lead one to suppose, is readily distinguishable from its eastern congener as set forth in the key to Nearctic species of this group given on a preceding page.

*Male.*—2.5 mm. long. Black: mandibles, except the tips which are reddish, palpi, labrum, clypeus, lower lateral corners of front along inner orbits to antennal sockets with an irregular trigonal spot, scapes, pedicel, and flagellum below, whitish-yellow. Fore legs except for femora above, and middle tarsi, deep yellow. Flagellum above, fore femora above, tegulae and axillary sclerites, fuscous to piceous. Wings clear hyaline with iridescent reflections, veins stramineous, stigma castaneous except for stramineous base.

Head glabrous, shining, minutely alutaceous; eyes truncate below, reaching to the bases of the mandibles, inner orbits shallowly arcuate, vertex subquadrately produced above dorsal margins of eyes for about half their length; ocelli in a low equilateral triangle, median ocellus situated about one-fourth the length of eyes above their dorsal margins. Antennae long, situated low on face just above dorsal margin of clypeus, about as far from each other as from the nearest eye margin; scapes very slightly bowed, about one-half the length of eyes; flagellum finely puberulent. Clypeus nitidous, narrow, transverse, subtruncate apically, medially with a subquadrate excision about as wide as one-third the length of eyes and reaching almost to the antennal sockets, lateral margins of excision obliquely divergent apically, lateral lobes of clypeus shallowly and weakly sinuate. Labrum transversely rectangular, filling the clypeal excision, the lateral apical corners rounded, apical margin truncate, very feebly retuse medioapically. Mandibles narrow, linear, unidentate apically and with a small tooth internally just before the apex. Clypeus and mandibles with ammochaetae. Temples and vertex shining, highly polished and impunctate.

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[21] After the Apache Indians who inhabit the southwestern United States.

Thorax with a fine, short, inconspicuous, decumbent coppery pubescence on mesonotum; pleura glabrous; mesosternum with appressed silvery pubescence. Pronotum narrow, transverse, gently declivous anteriorly to neck, situated below the level of the mesonotum and about one-half as wide as it, the tubercles almost attaining the tegulae. Mesonotum shining, with very fine, moderately close punctures, gradually and roundly declivous anteriorly to level of pronotum, anteriorly without impressions; scutellum and postscutellum glabrous, shining, highly polished and practically impunctate; pleura shining, very minutely subalutaceous, episternal suture distinct, vertical from below the anterior wing bases. Propodeum glabrous, shining, dorsally with a weak median longitudinal carinula becoming obsolescent posteriorly, laterad of which the surface is transversely weakly striate, posterior face with a weak median longitudinal sulcus dorsally, lateral faces obliquely striate. Legs moderately to heavily clothed with short silvery pubescence; femora subfusiform; tibiae somewhat incrassate apically; hind tarsi simple, terete.

Abdomen oval, somewhat depressed, shining, highly polished and impunctate, tergites folded under roundly to the venter and imbricate there with the sternites; tergites, particularly the fourth to last, and sternites with a preapical row of erect setulae; fifth to last sternite pubescent; third and fourth sternites finely, obscurely, transversely striate; fifth sternite truncate posteriorly, medio-apically with a pair of short, backward projecting, bifurcate prongs; apical margin broadly and shallowly retuse on each side of prongs; sixth sternite with apical margin arcuate, medially a little before apex with a short, narrow, transverse welt; seventh sternite elongate, the lateral margins somewhat divergent, apically shallowly and roundly emarginate; eighth sternite narrow, elongate, attenuate, tapering to bluntly rounded apex.

*Female.*—Unknown.

*Type.*—♂; Alamogordo, Otero County, New Mexico; June 6, 1902; (Henry L. Viereck); [Academy of Natural Sciences of Philadelphia, Type no. 4173].

*Paratypes.*—2 ♂; topotypic, June 6, 1902, and April 26, 1902, (Henry L. Viereck), [A.N.S.P.].

## PULVERRO[22] new genus

(Figs. 11, 12, 16, 18)

1890. *Ammoplanus* Kohl (in part) [*nec* Giraud], Ann. K. K. Naturhist. Hofmus., Wien, v, p. 61.

1892. *Ammoplanus* Fox [*nec* Giraud], Trans. Amer. Ent. Soc., XIX, p. 317.

1895. ? *Anacrabro* Provancher (in part only) [*nec* Packard], Nat. Canad., XXII, p. 142.

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[22] From *pulvis*, sandy, dusty soil + *erro*, a vagrant.

1898. *Ammoplanus* Cockerell [*nec* Giraud], Proc. Davenport Acad. Nat. Sci., VII, p. 147.

1898. *Ammoplanus* Ashmead [*nec* Giraud], Canad. Entom., XXXI, pp. 221–222.

1903. *Ammoplanus* Ashmead (in part) [*nec* Giraud], Ent. News, XIV, p. 295.

1909. *Ammoplanus* Rohwer [*nec* Giraud], Trans. Amer. Ent. Soc., XXXV, p. 101.

1931. *Ammoplanops* Gussakovskij (in part), Bol. Soc. Españ. Hist. Nat., XXXI, pp. 437–438; 457–458.

Head subquadrate in anterior aspect; eyes truncate below, reaching bases of mandibles, coarsely facetted anteriorly, finely facetted posteriorly, inner orbits subparallel, slightly arcuate; vertex subtruncate posteriorly, only slightly produced above dorsal margins of eyes; ocelli arranged in a low equilateral triangle; temples moderately wide above, tapering below. Labrum short, transverse, rounded or truncate apically. Clypeus narrow, transverse, more or less produced medially. Antennae inserted low on face just above dorsal margin of clypeus, almost twice as far from each other as from nearest eye margin. Mandibles edentate internally, bluntly bidentate apically. Maxillary palpi six-, labial palpi four-segmented.

Thorax with pronotum short, transverse, narrower than mesonotum, anteriorly transversely carinate, situated much below level of mesonotum which overhangs it, tubercles almost attaining the tegulae; mesonotum strongly thrust forward over pronotum, in dorsal aspect with the anterior margin biangulate, the more lateral portions straight, oblique and passing into the straight, transverse median portion by an obtuse angulation, notauli present anteriorly for one-third the length of mesonotum; mesopleura with episternal suture distinct, vertical from below tegulae; episternauli present, mesopleura therefore with a dorsal plate; propodeum flat above, truncate behind. Legs with the fore femora subsemicircular, upper margin straight, lower margin evenly arcuate; middle and hind femora fusiform; middle and hind tibiae somewhat incrassate apically, the middle pair furnished with one apical calcar, hind tibiae occasionally with a few weak spines posteriorly and two calcaria apically; females with a tarsal comb on fore tarsi.

Wings: fore wings with stigma large, twice as long as its greatest width, costal vein present distad of stigma; marginal cell closed, oblique and subtrapeziform; submarginal cell irregularly hexagonal; transverse cubital vein angulate, vertical above, strongly inclined and almost in line with the general course of the oblique recurrent vein below, at junction of the two ordinates with a distinct stump or spur of a vein which is apparently the vestige of a second transverse cubital vein that has coalesced anteriorly with the first transverse cubital vein to form a petiolate second submarginal cell which is incomplete due to the atrophy of the second abscissa of cubitus. Hind wing with the transverse cubital vein situated opposite or almost so the origin of the radial vein, the median cell therefore without a distinct digitus distally.

Abdomen sessile, oval, somewhat depressed, at least the second sternite with a transverse groove or impression anteriorly. Females with a distinct trigonal pygidium. Males with the seventh sternite deeply cleft medially, last sternite more or less spatulate, serrate, hirsute, and rounded or pointed apically, without a distinct pygidial area, the last tergite tapering, bluntly rounded apically.

GENOTYPE: *Pulverro mescalero* new species.

This genus is erected for the reception of new species from the southwestern United States and *Ammoplanus columbianus* which Kohl originally referred somewhat doubtfully to *Ammoplanus* and which Gussakovskij recently assigned to *Ammoplanops*, without apparently, however, having seen any material of Kohl's species. To this group, I have likewise tentatively allocated *Anacrabro laevis* Provancher, and very doubtfully *Anacrabro constrictus* Provancher. A discussion of each of these last two will be found on a following page under the respective species.

The present genus shows characters exhibited by both *Ammoplanops* and *Ammoplanus* but is in itself so clearly cut off from each that it could be included in either of them only by doing violence to recognized generic concepts. Ashmead, Cockerell, and Rohwer, apparently following Kohl, placed all the North American species of this group in *Ammoplanus* despite the fact that the distinctive venation of the fore wing, the subquadrate head with poorly developed vertical region, the strongly forward-thrust mesonotum, and the relatively simple apical abdominal sternites of the males contrast sharply with the typical forms of *Ammoplanus*, and stamp *Pulverro* as a group indubitably discrete from the former. The nearest relative of the latter is *Ammoplanops* with which it agrees in the shape of the head, the structure of the mesopleura, and the general facies of the abdomen, but differs from it in the general conformation of the mesonotum and the venation of the fore wing as given in the key to genera on a preceding page. Furthermore, the males of the present genus lack the median longitudinal keel or carina that Gussakovskij states is present on the last abdominal sternite of the males of *Ammoplanops*. The general habitus of *Pulverro* and *Ammoplanops* would seem to indicate that both have been derived from the same stock from which *Xylocelia* Rohwer [olim

*Diodontus* Auctt., *nec* Curtis] sprang, in sharp contradistinction to *Ammoplanus* which has quite evidently evolved from some Spilomenoid ancestor.

The singular venation of the fore wing will serve to immediately differentiate *Pulverro* from all other members of the Ammoplanoid complex. The stump or spur on the transverse cubital vein may be either an adventitious process or the vestige of the second transverse cubital vein, and has been found to be remarkably constant in the series of specimens of this genus before me. The distinctive structure of the mesonotum which is thrust forward so that it overhangs the pronotum is likewise relatively constant for all the forms treated on the following pages.

*Distribution.*—Widespread in North America west of the 110th meridian (New Mexico, Arizona, California, Colorado, Utah, and British Columbia), throughout the Sonoran, Transition, and Canadian life zones.

*Ethology.*—Nothing definite is known concerning the biology of the species of *Pulverro.* However, the presence of a rudimentary psammophore and a vestigial tarsal comb on the fore tarsi of the females, as well as the fact that a species was taken in Colorado resting on a sand bank, would seem to indicate that they build and excavate their nests or burrows in dry sandy or dusty soil. Like *Ammoplanus,* the species of Pulverro frequent flowers, such as *Eriogonum umbellatum,* where they may be taken sometimes in large numbers.

### *Key to the Species of Pulverro*

1. Males ........................................................ 2
   Females ........................................................ 5
2. Mandibles armed medially beneath with a large tooth projecting at right angles to the lower margin; (California).
   *chumashano* new species
   Mandibles simple, unarmed beneath ........................................ 3
3. Dorsal margin of clypeus medially between the antennal sockets with a small porrect spine; (British Columbia, Utah and Colorado).
   *columbianus* (Kohl)
   Dorsal margin of clypeus simple, unarmed.................................... 4
4. Clypeus discally with a raised subquadrate platform; last abdominal sternite spatulate, rounded apically; (New Mexico).
   *mescalero* new species
   Clypeus discally with a raised trigonal platform; last abdominal sternite tapering, pointed apically; (California)......*serrano* new species

5. Dorsal margin of clypeus medially between the antennal sockets with a small porrect spine; (British Columbia, Utah and Colorado). *columbianus* (Kohl)

Dorsal margin of clypeus simple, unarmed..........................6

6. Clypeus flat discally, the median part on the same level as the lateral portions; medio-apically with a broad, shallow, evenly arcuate sinus; (New Mexico)..........................*mescalero* new species

Clypeus distinctly tumid discally, medio-apically with a short, produced, truncate lobe ..........................7

7. Mesonotum thrust forward over pronotum and in dorsal aspect with the anterior margin biangulate, the more lateral portions straight, oblique and passing into the straight, transverse median portion by an obtuse angulation; pygidium shining, highly polished, with a few scattered punctures laterally; (Colorado)................*colorado* new species

Mesonotum not strongly thrust forward over pronotum but rounded and vertically declivous anteriorly, anterior margin evenly arcuate in dorsal aspect; pygidium semiopaque to shining, discally with a few scattered punctures; (California)...............*costano* new species

**Pulverro mescalero**[28] new species (Figs. 11, 12, 16, 18)

This, the typical species of *Pulverro*, is closely related in many respects to the more northernly distributed *P. columbianus* (Kohl) but differs from it in the much smaller size and in lacking a small porrect spine at the base of the clypeus between the antennal bases.

*Male.*—3 mm. long. Black; mandibles except apices which are red, palpi, labrum, flagellar segments beneath, middle and hind tibiae basally at knees with a broad ring, whitish-yellow. Fore femora light fulvous; tarsi light yellow, sometimes infuscated apically. Wings clear hyaline, veins and stigma fuscous.

Head subquadrate, semiopaque, obscurely and minutely subcoriaceo-reticulate, clypeus and lower half of front clothed with a fine, appressed, silvery pubescence, vertex and occiput more sparsely clothed with a very short, inconspicuous, semi-erect, subaeneous pubescence. Eyes minutely and inconspicuously finely puberulent, reaching bases of mandibles below and truncate there, inner orbits shallowly arcuate, subparallel; vertex subquadrately arched, extending above dorsal margins of eyes for about one-sixth their length; ocelli in a low equilateral triangle, median ocellus situated on a line with dorsal margins of eyes. Front with lower half broadly and shallowly concave between eyes. Antennae moderately long, reaching about as far as tegulae, situated low on face a little above dorsal margin of clypeus, about two-thirds as far from nearest eye margin as from each other; scapes one-third the length of eyes, straight, slightly incrassate distad; flagellum finely puberulent. Clypeus transverse, subfusiform, medially about one-fourth as long as length of eyes, discally raised into a low, flat, subquadrate platform which is slightly produced medio-apically into a broad subtruncate lobe, the apical margin of which is inconspicuously beaded and very shallowly and broadly, arcuately excised. Labrum transverse, subrectangular, latero-distal angles rounded, apical margin truncate. Mandibles with a large tooth apically and a small one internally just before apex.

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[28] After the Mescalero Indians, a tribe of the Apaches inhabiting south-central New Mexico.

Thorax shining; mesonotum, scutellum, and postscutellum with very short, inconspicuous pubescence; pleura largely glabrous; mesosternum with longer, appressed, silvery pubescence. Pronotum narrow, linear, transverse, situated much below level of mesonotum, transversely carinate anteriorly, tubercles not attaining the tegulae but remote from them. Mesonotum minutely acupunctate, thrust forward over pronotum, anteriorly biangulate, the anterior margin with more lateral portions straight, oblique and passing into the straight, transverse median portion by an obtuse angulation; notauli present on anterior half of mesonotum; suture between mesonotum and scutellum strongly impressed and foveolate; scutellum and postscutellum punctured like mesonotum but more sparsely so; mesopleura finely subaciculate before episternal suture and above episternauli, remainder shining, highly polished and impunctate; metapleura semiopaque, subgranulate. Propodeum semiopaque, subgranulate; dorsal face irregularly, inconspicuously, weakly reticulate, medially with two longitudinal, subparallel, widely separated carinulae; posterior face with a shallow, median longitudinal, cuneate sulcus dorsad.

Abdomen shining, highly polished, minutely acupunctate to obscurely transversely semi-aciculate; tergites and sternites constricted basally; sparsely clothed with a short, decumbent, argenteo-aeneous pubescence; last tergite without a pygidium, last sternite spatulate, apical margin rounded, serrate, and densely hirsute.

*Female.*—3 mm. long. Similar to male except as follows: Clypeus narrow, transverse, flat and on same plane throughout, not produced medio-apically but broadly, shallowly, arcuately excised. Temporal ammochaetae present. Propodeum with stronger reticulations on dorsal face. Abdomen with a trigonal pygidium, lateral margins straight, apex narrowly rounded, discally shining, highly polished and impunctate save for a few punctures laterally. Fore tarsi with a short, inconspicuous tarsal comb. Fore femora and trochanters with short, inconspicuous ammochaetae.

*Type.*—♂; High Rolls, Otero County, New Mexico; June 12, 1902; (Henry L. Viereck); [Academy of Natural Sciences of Philadelphia, Type no. 4175].

*Allotype.*—♀; same data as type, [A.N.S.P.].

*Paratypes.*—1 ♀; same data as type, [A.N.S.P.]. 23 ♂; topotypical, May 29 to June 12, 1902, (Henry L. Viereck), [A.N.S.P.]. 1 ♂; Alamogordo, Otero County, New Mexico, June 13, 1902, (Henry L. Viereck), [A.N.S.P.].

**Pulverro columbianus** (Kohl) (Fig. 4)

1890. *Ammoplanus (?) columbianus* Kohl, Ann. K. K. Naturhist. Hofmus., Wien., v, p. 61. [♀.]

1892. *Ammoplanus ? columbianus* Fox, Trans. Amer. Ent. Soc., xxix, p. 317. [♀.]

1898. *Ammoplanus columbianus* Ashmead, Canad. Ent., xxxi, p. 222. [♀.]

1909. *Ammoplanus eriogoni* Rohwer, Trans. Amer. Ent. Soc., xxxv, p. 101. [♂.]

1931. *Ammoplanops columbianus* Gussakovskij, Bol. Soc. Españ. Hist. Nat., xxxi, pp. 437, 458.

*Type.*—♀; Lytton, British Columbia, Canada; [Natural History Museum, Vienna].

Although I have not seen the type of Kohl's species, nevertheless, his description is sufficiently full and clear to leave no doubt in my mind that the material I have identified as *Ammoplanus (?) columbianus* Kohl is that species. I have examined the type of *Ammoplanus eriogoni* Rohwer in the United States National Museum and, despite Rohwer's contention to the contrary, I feel reasonably certain that his species represents merely the opposite sex of Kohl's form.

The closest relative of *Pulverro columbianus* is *P. mescalero* with which it agrees in the structure of the last abdominal sternite and the general conformation of the clypeus, but differs from it, as well as all the other known members of the genus, by the small porrect spine at the base of the clypeus between the antennal sockets.

*Distribution.*—A widespread northern montane form ranging from southern British Columbia south to central Colorado, apparently confined to the Canadian, Transition, and upper reaches of the upper Sonoran zones.

*Specimens examined.*—COLORADO: ♂, Florissant, July 19, 1906, (T. D. A. Cockerell; at flowers of *Eriogonum umbellatum*.), [*type* of *Ammoplanus eriogoni* Rohwer; United States National Museum]. UTAH: ♂, North Fork of Duchesne River, July 13–14, 1927, (J. C. Bradley), [Cornell University].

**Pulverro serrano**[24] new species (Fig. 9)

This species is readily distinguishable from all the other known members of *Pulverro* by the structure of the clypeus and the general conformation of the last abdominal sternite and tergite. It may eventually prove to be the species that Provancher described in 1895 as *Anacrabro constrictus*, but his description is too inadequate to enable one to recognize it short of an examination of the type. Moreover, Provancher states that in *Anacrabro constrictus* the abdomen is shortly petiolate, whereas in the present species the abdomen is distinctly sessile.

*Male.*—3 mm. long. Black; mandibles except apices which are red, whitish yellow; fore tibiae entirely, middle and hind tibiae basally and at apex, all tarsi, tegulae, and axillary sclerites, light fulvous. Wings clear hyaline, veins and stigma dark fuscous.

Head subquadrate in anterior aspect, semiopaque, finely granulate, clypeus and lower half of face with fine, appressed silvery pubescence. Eyes reaching bases of mandibles, inner orbits shallowly arcuate, subparallel; vertex extending in an even low arch above dorsal margins of eyes for about one-sixth their length; ocelli in a low triangle, median ocellus on a line with the dorsal margins of eyes. Antennae reaching about as far as tegulae, inserted low on face just above dorsal margin of clypeus, about twice as far from each other as from nearest eye margin; scapes about two-sevenths the length of eyes, straight, somewhat clavate apically; flagellum finely puberulent. Clypeus narrow, transverse, subfusiform, medially about two-sevenths the length of eyes, produced medio-apically into a very short, broad, truncate lobe, the apical margin of which is furnished with a row of short, moderately stout ammochaetae, discally raised into a flat, subtrigonal platform which passes above into a lower and smaller subtrigonal tumid area on front between antennal bases, the latter continuing dorsad on front as a fine, median, longitudinal carinula for about one-half length of eyes. Labrum short, narrow, transverse, apical margin broadly rounded. Mandibles narrow, sublinear, apically bidentate; lower margin entire, simple, without a tooth, provided with a few ammochaetae.

Thorax shining, with fine, decumbent, subaeneous pubescence, and fine, well separated acupuncturation; pronotum and mesonotum of the usual conformation; suture between mesonotum and scutellum impressed and finely foveolate; metapleura subgranulate. Propodeum glabrous, shining, finely granulate; dorsal face discally with two parallel, well separated, longitudinal carinae occasionally connected with each other by fine transverse carinulae, laterad of which the surface is traversed by a few more or less parallel, oblique carinulae, posterior margin edged with a transverse carinula separating dorsal face from posterior face which has a small, median, cuneate fovea dorsally. Legs clothed with a fine, appressed, silvery pubescence.

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[24] After the Serrano Indians, a tribe of the Shoshones formerly inhabiting south-central California.

Abdomen oval, shining, constricted somewhat between the sutures, last segments abruptly deflexed; clothed with a decumbent silvery pubescence which is more noticeable on sternites and posterior tergites; tergites and sternites with a low, inconspicuous, transverse ridge preapically; last tergite elongate trigonal, apex acute; second and third sternites with a shallow transverse sulcus basally, sixth sternite concave, shining, highly polished, and impunctate, last sternite elongate, tapering, apex acuminate, serrate, and densely hirsute apically.

*Female.*—Unknown.

*Type.*—♂ ; Altadena, Los Angeles County, California; August 25, 1907; (James A. G. Rehn); [Academy of Natural Sciences of Philadelphia, Type no. 4177].

**Pulverro colorado**[25] new species (Fig. 10)

This species has the general habitus of the anomalous *Pulverro costano*, but differs from it in the general conformation of the mesonotum and pronotum and the pygidium, and also by lacking the narrow, transverse, semitranslucent, clypeal flange which is so characteristic of that species.

*Female.*—3.5 mm. long. Black; mandibles except extreme apices which are red, palpi and labrum, whitish-yellow; pedicel, flagellum, fore tibiae, all tarsi, and middle and hind tibiae with a narrow ring basally, fulvous. Wings clear hyaline, veins and stigma dark fuscous.

Head shining, front and vertex with fine, sparse puberulent pubescence, lateral lobes of clypeus with fine, appressed, silvery pubescence. Eyes truncate below, reaching bases of mandibles, inner orbits slightly arcuate, subparallel; front and vertex with fine, well separated acupuncturation; vertex and ocelli of the usual conformation. Antennae short, only reaching about as far as occiput, situated low on face just above dorsal margin of clypeus, about one-half as far from nearest eye margin as from each other, scapes straight, about one-third the length of eye, flagellum finely puberulent. Clypeus transverse, subfusiform, medially about one-fifth as long as eyes, with a weakly produced, truncate lobe medially, the apical margin of which is finely beaded and furnished with a row of moderately long and stout ammochaetae, discally tumid, glabrous, shining, highly polished and impunctate. Labrum narrow, transverse, apical margin evenly rounded. Mandibles with ammochaetae along lower margin. Temporal ammochaetae present but poorly developed.

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[25] After the state of Colorado.

Thorax shining; dorsally and pleura clothed with a very fine, inconspicuous puberulent pubescence, mesosternum with heavier, appressed, silvery pubescence; pronotum and mesonotum of the usual conformation; mesonotum, scutellum, and postscutellum with fine, well distributed puncturation, suture between mesonotum and scutellum impressed and finely foveolate; mesopleura minutely coriaceous before episternal suture and above episternauli, remainder shining, highly polished, practically impunctate; metapleura opaque, subgranulate. Propodeum opaque, subgranulate; dorsal face irregularly reticulate discally; posterior face with a shallow, median longitudinal sulcus, laterad of which the surface is obscurely transversely substriate, dorsal margin edged by a weak transverse carinula; lateral faces shining, subgranulate anteriorly, obscurely, obliquely rugulose posteriorly. Fore legs with vestiges of a comb on tarsi, and with a few short inconspicuous ammochaetae developed on trochanters and femora; hind tibiae with posterior margins simple, unarmed; hind tarsi simple, terete.

Abdomen shining, highly polished, minutely acupunctate to transversely semi-acuminate, not appreciably constricted between the segments, clothed with a short, decumbent, silvery pubescence which is more noticeable on posterior segments; second sternite anteriorly with a transverse, arcuate sulcus; pygidium elongate trigonal, lateral margins straight, apex narrowly truncate, discally shining, highly polished, and with a few punctures laterally.

*Male.*—Unknown.

*Type.*—♀ ; Canyon of the Cache la Poudre, 20 miles west of Fort Collins, Colorado; June 13, 1933; (V. S. L. Pate; on sand bank at edge of stream); [Academy of Natural Sciences of Philadelphia, Type no. 4176].

**Pulverro costano**[26] new species (Fig. 6)

This is a somewhat anomalous species of *Pulverro* in that the mesonotum instead of being thrust forward over the pronotum is merely strongly arched and vertically declivous anteriorly to the level of the pronotum, although there is a tendency for the former to somewhat overhang the latter. However, in some of the females of the present genus the characteristic conformation of the mesonotum is not quite so marked as in the males, consequently inasmuch as *P. costano* is known at present from only the female sex, it is not unlikely that when the male is discovered, it will be found to possess the type of mesonotum that is so characteristic of its congeners. Like *Pulverro colorado, P. costano* has the disc of the clypeus strongly inflated but differs from that species by the clypeus possessing a narrow, transverse, semitranslucent flange medioapically, and by a different general conformation of the pygidium.

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[26] After the Costanoan Indians who inhabited western California south of the Golden Gate.

*Female.*—3 mm. long. Black; mandibles except apices which are red, labrum, and palpi, whitish yellow; clypeus medio-apically, flagellum beneath, fore tibiae entirely, middle and hind tibiae at base and apex, all tarsi, light fulvous. Wings clear hyaline, veins and stigma light fuscous.

Head subquadrate, shining; clypeus laterally with fine, appressed, silvery pubescence; face with sparse, decumbent, very short subaeneous hairs and minutely subcoriaceo-reticulate. Eyes reaching bases of mandibles below, inner orbits shallowly arcuate, subparallel; vertex broad and evenly arched above dorsal margins of eyes for about one-sixth their length; ocelli situated in a low triangle, median ocellus on a line with dorsal margins of eyes. Antennae moderately short, reaching about to occiput, inserted low on face just above dorsal margin of clypeus, about as far from each other as from nearest eye margin; scapes straight, widened distally, length about one-third that of eyes; flagellum finely puberulent. Clypeus narrow, transverse, subfusiform, length medially about one-third that of eye; medioapically produced into a narrow, transverse, wide, semitranslucent flange, discally roundly tumid and shining, highly polished, and impunctate; apically with short, moderately stout ammochaetae. Labrum narrow, transverse, apical margin broadly rounded. Mandibles semifalcate, internally just before apex with a small tooth, lower margin simple, without tooth, with a few ammochaetae. Temporal ammochaetae present but weak.

Thorax shining, with pubescence similar to that of face; pronotum very narrow, linear, transversely carinate anteriorly, tubercles almost attaining tegulae; mesonotum with fine, well separated acupuncturation, not thrust forward over pronotum but roundly arched and vertically declivous anteriorly to level of pronotum, fore margin evenly arcuate, notauli present anteriorly for about one-third length of mesonotum; suture between mesonotum and scutellum impressed and minutely foveolate; scutellum and postscutellum punctured like mesonotum but more sparsely so; mesopleura finely acupunctate before episternal suture and above episternauli, remainder shining, highly polished, and impunctate; metapleura subgranulate. Propodeum shining, glabrous, minutely granulate; dorsal face medially with three longitudinal subparallel carinae which diverge slightly caudad, laterad of which the surface is weakly, irregularly reticulate, posterior margin edged by a transverse carinula separating dorsal face from posterior face which has a small cuneate fovea dorsally; lateral faces granulate and longitudinally to obliquely striate. Legs clothed with fine, appressed pubescence; fore tarsi with vestiges of a short tarsal comb; fore tibiae with traces of ammochaetae.

Abdomen oval, shining, finely acupunctate to transversely semiaciculate, not appreciably constricted between the segments, clothed with a fine, decumbent, whitish pubescence which is more noticeable on sternites and posterior tergites; second sternite with a shallow, transverse sulcus basally; pygidium shining, elongate trigonal, lateral margins weakly, arcuately excavate, apex narrowly rounded, discally obscurely subcoriaceo-reticulate with a few scattered punctures.

*Male.*—Unknown.

*Type.*— ♀ ; Santa Clara County, California; [Cornell University, Type no. 1375].

*Paratypes.*—3 ♀ ; same data as type.

**Pulverro chumashano**[27] new species (Figs. 7, 20)

This very distinctive species, although indubitably a member of this genus, is quite isolated from all the other known members of *Pulverro* by the characteristic structure of the mandibles, the antennal scapes, and the general conformation of the abdominal sternites. It is evidently a member of the peculiar, ancient, southern Californian coastal fauna that has so many affinities with the small off-shore islands. When the female of *Pulverro chumashano* is known, it may be desirable to recognize it as a group subgenerically distinct from the typical *Pulverrones*.

*Male.*—3 mm. long. Black; mandibles except the apices and the tip of tooth on ventral margin which are red, labrum, palpi, whitish-yellow; fore tibiae entirely, middle and hind tibiae basally at knees with a broad ring, all calcaria and tarsi, light fulvous; scapes, flagellum beneath, and apex of abdomen with a tendency to become dark fulvous to castaneous. Wings clear hyaline, veins and stigma dark fuscous.

Head subquadrate, opaque, finely granulate, clypeus laterally and sides of front below clothed with fine, appressed, silvery pubescence. Eyes minutely puberulent, reaching bases of mandibles below, inner orbits shallowly arcuate, subparallel with a tendency to converge below; vertex extending in an even low arch for about one-sixth the length of eyes above their dorsal margins; ocelli in a low triangle, median ocellus situated on a line with the dorsal margins of eyes. Antennae reaching about to tegulae, inserted low on face just above dorsal margin of clypeus about as far from each other as from nearest eye margin; scapes short, about two-sevenths the length of eye, clavate apically; flagellum finely puberulent, about six to seven times as long as scapes. Clypeus narrow, transverse, subfusiform, medially about one-sixth as long as eye, medio-apically weakly produced into a very short, broad, squarely truncate median lobe, the apical margin of which is furnished with a row of short, moderately stout ammochaetae, raised discally into a tumid, subquadrate platform which is glabrous, shining, highly polished and impunctate. Labrum short, narrow, transverse, apical margin broadly and evenly rounded. Mandibles semifalcate, with a small tooth internally just before apex; lower margins with a few short ammochaetae and medially with a large, blunt, subtrigonal tooth placed at right angles to lower edge.

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[27] After the Chumashan Indians who inhabited the coastal region of southern California.

Thorax shining, highly polished; dorsal surface, pleura, and propodeum with very short, inconspicuous, decumbent, argenteo-aeneous pubescence, mesosternum with longer appressed, silvery pubescence. Pronotum and mesonotum of the usual conformation; mesonotum, scutellum and postscutellum with fine, well separated acupuncturation; suture between mesonotum and scutellum impressed and distinctly foveolate; metapleura longitudinally striate. Propodeum shining to semiopaque, subgranulate; dorsal face with a pair of well separated, longitudinal, parallel carinulae medially, laterad of which the surface is finely and irregularly reticulate, posterior margin edged by a transverse carinula separating the dorsal face from the posterior face which has a small, median, cuneate fovea dorsally; lateral faces shining, obliquely striate. Legs clothed with fine, appressed, silvery pubescence.

Abdomen shining, highly polished, oval, constricted at sutures, clothed with a fine, decumbent, whitish pubescence which is more noticeable on posterior tergites and venter; tergites with fine acupuncturation to transversely obscurely semi-aciculate, pre-apically with a fine, inconspicuous, transverse ridge; sternites with fine, close puncturation, the second and three following ones with a shallow, transverse sulcus basally, sixth sternite shining, highly polished, impunctate, transversely concave, seventh sternite retracted beneath sixth and deeply cleft medio-apically, last sternite spatulate, apex subtruncate and densely hirsute.

*Female.*—Unknown.

*Type.*—♂; Lompoc, Santa Barbara County, California; September 9, 1908; (J. C. Bradley); [Cornell University, Type no. 1376].

*Paratype.*—♂; same data as type.

The following species have been assigned to *Ammoplanus* by various authors, but owing to the inadequacy of the descriptions I have been unable to recognize them. It is hardly likely that they belong to *Ammoplanus* according to our modern concept of the group, and I have tentatively assigned them to *Pulverro* until such time as I shall be able to examine the types, which at present are not readily accessible, and allocate them definitely to their proper generic position.

**Pulverro (?) laevis** (Provancher)

1895. *Anacrabro laevis* Provancher, Nat. Canad., XII, p. 142. [♀; Los Angeles, California.]

1898. *Ammoplanus laevis* Cockerell, Proc. Davenport Acad. Sci., VII, p. 147. [New Mexico: Mesilla; Mesilla Park. Texas: El Paso.]

1899. *Ammoplanus laevis* Ashmead, Canad. Ent., XXXI, p. 222. [♂.]

1903. *Ammoplanus* (*Anacrabro*) [sic] *lævis* Ashmead, Ent. News, XIV, p. 295.

1917. *Anacrabro laevis* Gahan & Rohwer, Canad. Ent., XLIX, p. 306. [♀.]

*Type.*— ♀; Los Angeles, California; (Coquillett); [Public Museum of Quebec].[29]

This is one of the two species which Provancher described and incorrectly placed in *Anacrabro.* Ashmead and Cockerell without having seen Provancher's type, so far as I am aware, have allocated it to *Ammoplanus,* but I doubt very much if it may be assigned to that genus according to our present concept of the group. For the present I have consequently placed it tentatively in *Pulverro* until I have had an opportunity to examine Provancher's type and confirm my suspicion that it should be assigned to the present genus.

In 1915, Gahan and Rohwer made an examination of the various Canadian collections that contained Provancher's types with a view to selecting lectotypes of his species. In their report,[28] they have appended taxonomic notes on the correct systematic position of some of Provancher's species, particularly in the sawflies and parasitoids, but in the case of the aculeates they have, as a rule, given nothing save the bare data associated with the type. For *Anacrabro laevis* they state: " Type.—Female, yellow label 1691. 2nd Coll. Public Museum of Quebec." [29]

**Pulverro (?) constrictus** (Provancher)

1895. *Anacrabro constrictus* Provancher, Nat. Canad., XII, p. 141. [♀; Los Angeles, California.]

1899. *Ammoplanus constrictus* Ashmead, Canad. Ent., XXXI, p. 222. [♀.]

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[28] Gahan, A. B. and S. A. Rohwer. Lectotypes of the species of Hymenoptera (except Apoidea) described by Provancher. *Canad. Ent.*, XLIX, pp. 298–308; etc., (1917).

[29] *i. e.* the Dernière Provancher Collection which came to the Museum through purchase after Provancher's death. This collection is housed in the Museum of Natural History, Department of Public Instruction, Parliamentary Building, Quebec.

1909. *Ammoplanus constrictus* Rohwer, Trans. Amer. Ent. Soc., xxxv, p. 102.
1917. *Anacrabro constrictus* Gahan & Rohwer, Canad. Ent., xlix, p. 306. [♂.]

*Type.*— ♂, Los Angeles, California; (Coquillett); [Public Museum of Quebec].[29]

This species, described originally by Provancher as an *Anacrabro,* has been assigned to *Ammoplanus* by Ashmead and Rohwer, albeit somewhat doubtfully by the latter. It is probably a Pemphredonid rather than a Crabronine, but I doubt very much if it belongs to the genus *Ammoplanus* as now understood. I should be inclined to assign it almost without hesitation to *Pulverro* were it not for Provancher's statement ". . . Abdomen brièvement pédiculé . . ." There is a possibility that it may eventually prove to be a *Stigmus,* but this point can not be settled until the type has been examined. Gahan and Rohwer give no notes on the systematic position of this species in their report [28] on the Provancher types, merely stating: " *Anacrabro constrictus. Type.*—Male, tag mounted, yellow label 1690. 2nd Coll. Pub. Mus., Quebec." [29]

## AMMOPLANOPS Gussakovskij

(Figs. 1, 3, 15)

1903. *Ammoplanus* Ashmead [*nec* Giraud], Ent. News, xiv, p. 295.
1931. *Ammoplanops* Gussakovskij (in part), Bol. Soc. Españ. Hist. Nat., xxxi, p. 457.

Genotype: *Ammoplanops carinatus* Gussakovskij. (By original designation.)

The present genus is definitely related in a number of respects to *Pulverro,* the two being clearly members of the same group of the Ammoplanoid complex. As has been pointed out in a foregoing page, Gussakovskij attempted to place *Ammoplanus* (?) *columbianus* Kohl in this genus but a careful examination of material of this species has convinced me that it must be assigned to the new and closely related genus *Pulverro.* The chief characters differentiating these two have been given in the key to genera on a preceding page and also under the discussion of the latter. Inasmuch as Gussakovskij has given an excellent characterization of the genus in his paper on the Palaearctic species of *Ammoplanus* and related genera, no generic diagnosis of *Ammoplanops* is offered here.

*Distribution.*—Discontinuous, with one species occurring in the lower Sonoran zone of New Mexico and Arizona in North America, and three species in Khoresm and northwestern Turkestan of the Transcaspian region of the old world.

*Nearctic components.*—But one Nearctic species, *Ammoplanus cockerelli* Ashmead, may at present be assigned with any certainty to *Ammoplanops,* although there is a possibility that it may be necessary to ultimately allocate *Anacrabro laevis* Provancher to this genus when the type of this species has been examined.

*Ethology.*—Nothing definite is known concerning the biology of the members of this genus. However, the presence of a psammophore in the females would seem to indicate that they construct their nests in dry sandy or dusty soil. Like many other species of this general complex, the adults of *Ammoplanops* frequent flowers, such as mesquite, where they may often be taken in large numbers.

**Ammoplanops cockerelli** (Ashmead) (Figs. 1, 3, 15)

1903. *Ammoplanus cockerelli* Ashmead, Ent. News, xiv, p. 295. [♀.]

An examination of the type of *Ammoplanus cockerelli* Ashmead in the United States National Museum has revealed that it is an *Ammoplanops,* the first and, so far as is known, still the only species of the genus present in North America. More intensive collecting, however, in the southwestern United States and northern Mexico should result in the addition of more species of this genus to our known fauna. Ashmead's description of the female is quite inadequate; consequently I have given a redescription of the species based upon the material I have had before me. I am reasonably confident that the males reported and described here for the first time are the opposite sex of Ashmead's species despite the great disparity in the shape of the clypeus. *Ammoplanops cockerelli* is apparently widely distributed through the lower sonoran zone of the southwestern United States.

*Female.*—2.5–3 mm. long. Black; mandibles except apices which are red, labrum, palpi, tegulae, all femora apically, fore tibiae entirely, middle and hind tibiae basally at knees, all tarsi, whitish-yellow; pedicel, flagellum beneath, middle and hind tibiae medially, light fulvous. Wings clear hyaline, veins stramineous, stigma fulvous.

Head subquadrate in anterior aspect; shining; clypeus with short, appressed, silvery pubescence, front with shorter, more sparse, light, decumbent pubescence. Eyes truncate below, reaching to bases of mandibles, inner orbits shallowly arcuate, converging slightly below; vertex extending in a low even arch above dorsal margins of eyes for about one-sixth their length; ocelli in a low triangle, median ocellus on a line with dorsal margins of eyes; front flat, with fine, well separated acupuncturation. Antennae short, reaching to occiput or but slightly beyond, inserted low on face just above dorsal margin of clypeus; scapes about one-third the length of eyes, straight, slightly incrassate distad; flagellum finely puberulent. Clypeus flat, transverse, subfusiform, medially one-fourth the length of eyes; weakly produced medially into a very short, broad, truncate lobe the apical margin of which is inconspicuously beaded and provided with a row of short, moderately stout ammochaetae; discally somewhat tumid. Labrum short, narrow, transverse, Mandibles narrow, sublinear, apically bidentate, lower margin simple, entire, with a few short ammochaetae. Temporal ammochaetae present.

Thorax shining, highly polished, dorsally with fine, decumbent, short, light pubescence, mesosternum with appressed, silvery pubescence. Pronotum narrow, linear, transverse, situated much below level of mesonotum, transversely carinate anteriorly, tubercles almost attaining tegulae. Mesonotum with fine, well separated acupuncturation, strongly arched and vertically declivitous anteriorly to level of prontum but not thrust forward over the latter, anterior margin evenly arcuate, notauli present on anterior fourth; suture between mesonotum and scutellum impressed and foveolate; scutellum and postscutellum punctured like mesonotum; mesopleura with puncturation similar to mesonotum, episternal suture vertical from below tegulae, episternauli present; metapleura shining, minutely subgranulate. Propodeum shining, glabrous, finely granulate; dorsal face medially with two parallel, well separated, longitudinal carinae, laterad of which are a number of weak, irregular, longitudinally oblique carinulae, posterior margin edged by a transverse carinula separating the dorsal from the posterior face which has a median longitudinal sulcus. Legs clothed with fine, appressed, silvery pubescence; fore trochanters and femora with short ammochaetae; fore tarsi with a weak, inconspicuous tarsal comb; middle and hind tibiae weakly spinose along posterior margins.

Abdomen oval, shining to semiopaque, highly polished, minutely acupunctate to obscurely transversely semi-aciculate; clothed with a fine, decumbent, silvery pubescence which is more noticeable on posterior segments and venter; not appreciably constricted between segments; pygidium elongate trigonal, lateral margins straight, apex narrowly rounded, discally highly polished and with a few scattered punctures; second sternite with a shallow, transverse, arcuate sulcus basally.

*Male.*—2.5–3 mm. long. Similar to female except as follows: clypeus heavily clothed with appressed, silvery pubescence; antennae inserted toward middle of face, about one-sixth the length of eyes above their ventral margins; front broadly, shallowly concave between the eyes; clypeus narrow and transversely adamantiform, longitudinally tectiform, discally with a median longitudinal cristate keel ending medio-apically in a small rounded tooth, laterad of which on each side is a small lateral tooth, median dorsal margin of clypeus with a minute porrect tooth. Abdomen without a pygidium, last sternite elongate, spatulate, apical margin serrate and hirsute.

*Type.*— ♀ ;Las Cruces, New Mexico; September 23; (T. D. A. Cockerell); [United States National Museum, Type no. 6930].

*Allotype.*— ♂ ; High Rolls, Otero County, New Mexico, May 29, 1902, (Henry L. Viereck), [Academy of Natural Sciences of Philadelphia].

*Specimens examined.*—NEW MEXICO: 1 ♀, Las Cruces, Dona Ana County, September 23, (T. D. A. Cockerell), [*type;* United States National Museum]; 2 ♂, Highrolls, Otero County, May 29 and June 13, 1902, (Henry L. Viereck), [Academy of Natural Sciences of Philadelphia]; 1 ♂, Alamogordo, Otero County, June 6, 1902, (Henry L. Viereck), [A.N.S.P.]. ARIZONA: 5 ♂, Yuma, Yuma County, May 3–5, 1918, (J. C. Bradley), [Cornell University]. CALIFORNIA: 2 ♀, 10 ♂, Needles, San Bernardino County, April 1–6, 1918, (J. C. Bradley), [Cornell University].

The following forms have appeared in the literature as North American species of *Ammoplanus.*

**Ammoplanus mandibularis** Ashmead MS

1897. *Ammoplanus* sp. Cockerell, Ann. & Mag. Nat. Hist., (6), XIX, p. 402. [Santa Fé, New Mexico.]

1898. *Ammoplanus mandibularis* Ashmead MS [in Cockerell], Proc. Davenport Acad. Nat. Sci., VII, p. 148. [Santa Fé, New Mexico.]

Insofar as I have been able to determine, no reference other than those given above have appeared to this species. Inasmuch as no description has ever been published, Ashmead's manuscript name *Ammoplanus mandibularis* is a nomen nudum and will not preoccupy *Ammoplanus mandibularis* Cameron, 1903 described from South Africa.[80] It is possible that Ashmead's manuscript name may be the species which he described in 1903 as *Ammoplanus cockerelli* [=*Ammoplanops cockerelli* (Ashmead)].

**Crabro salicis** (Cockerell)

1897. *Ammoplanus salicis* Cockerell, Ann. & Mag. Nat. Hist., (6), XIX, p. 402. [♀; Las Cruces, New Mexico; on *Salix*.]

1898. *C*[*rabro*] *salicis* Cockerell, Proc. Davenport Acad. Nat. Sci., VII, p. 148. [Mesilla Valley, New Mexico.]

This species was originally described as an *Ammoplanus*, but Professor Cockerell informs me [*in litt.*] that ". . . *Ammoplanus salicis* is a species of *Crabro* (*s. lat.*) . . ."

## EXPLANATION OF PLATES

### PLATE VIII

Fig. 1.—Head of *Ammoplanops cockerelli* (Ashmead), female.
Fig. 2.—Head of *A.* (*Ammoplanus*) *unami* new species, female.
Fig. 3.—Head of *Ammoplanops cockerelli* (Ashmead), male.
Fig. 4.—Head of *Pulverro columbianus* (Kohl), male.
Fig. 5.—Head of *Ammoplanus* (*Ammoplanellus*) *lenape* new species, male.
Fig. 6.—Head of *Pulverro costano* new species, female.
Fig. 7.—Head of *Pulverro chumashano* new species, male.
Fig. 8.—Head of *Ammoplanus* (*Ammoplanellus*) *apache* new species, male.
Fig. 9.—Head of *Pulverro serrano* new species, male.
Fig. 10.—Head of *Pulverro colorado* new species, female.
Fig. 11.—Head of *Pulverro mescalero* new species, male.
Fig. 12.—Head of *Pulverro mescalero* new species, female.

### PLATE IX

Fig. 13.—Fore wing of *Ammoplanus* (*Ammoplanellus*) *lenape* new species.
Fig. 14.—Fore wing of *A.* (*Ammoplanus*) *unami* new species.
Fig. 15.—Fore wing of *Ammoplanops cockerelli* (Ashmead).
Fig. 16.—Fore and hind wing of *Pulverro mescalero* new species.
Fig. 17.—Fore wing of *Xysma ceanothae* (Viereck).
Fig. 18.—Lateral view of thorax of *Pulverro mescalero* new species.
Fig. 19.—Head of *Xysma ceanothae* (Viereck).
Fig. 20.—Mandible of *Pulverro chumashano* new species.
Fig. 21.—Ventral view of end of abdomen of *Ammoplanus* (*Ammoplanellus*) *lenape* new species, male.

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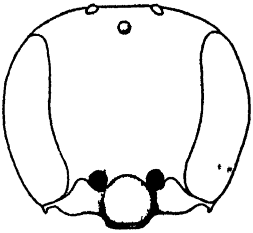
[30] See footnote 16.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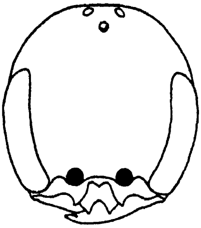
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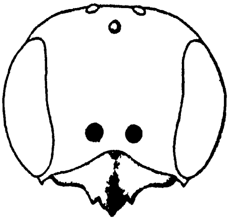
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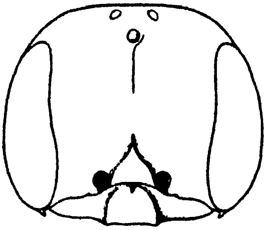
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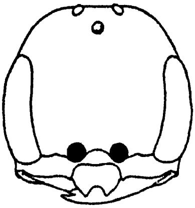
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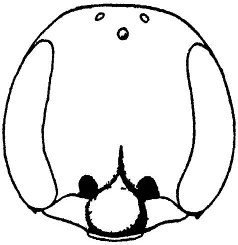
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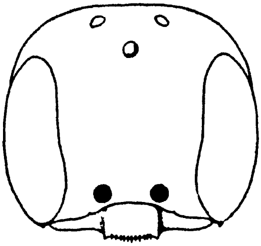
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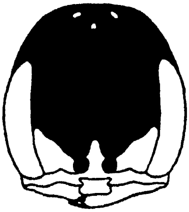
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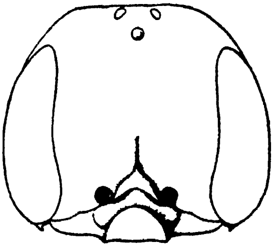
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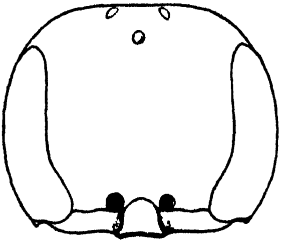
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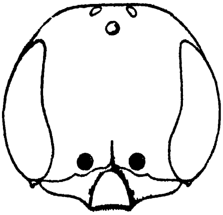
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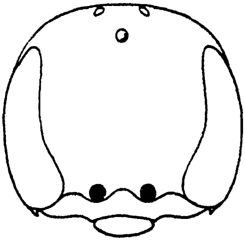
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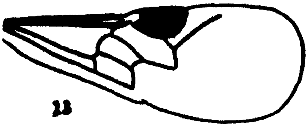
PATE—PEMPHREDONINE WASPS



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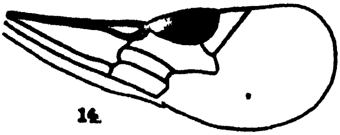

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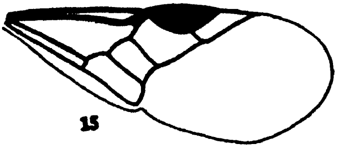

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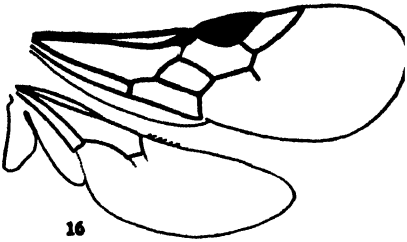

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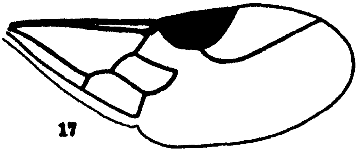

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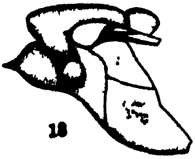

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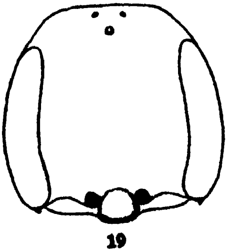

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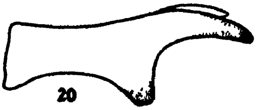

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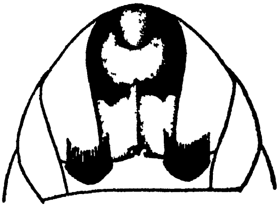

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PATE—PEMPHREDONINE WASPS

# MISCELLANEOUS STUDIES IN THE COLEOPTERA, NO. 5[1]

## (TENEBRIONIDAE AND MELYRIDAE)

BY FRANK E. BLAISDELL, SR.

*Stanford Medical School and Associate in Research,*
*California Academy of Sciences, San Francisco, California.*

Recently it has been the author's good fortune, to have had the opportunity to study large series of *Eleodes,* from several geographical regions that yield species of great interest to the entomologist. I refer particularly to the Huachuca, Chiricahua and Graham Mountains of Arizona. The material necessitated the creation of two new subgenera of *Eleodes* as defined below, one of which was fore-shadowed in my Monograph of the Eleodiini.[2] A number of the Mexican species will have to be referred to these new subgenera.

I am indebted to the State Natural History Survey Division of Urbana, Illinois and, Herbert H. Ross, Systematic Entomologist, who submitted the material for study and determination. To the Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma and, John Standish of the Entomological Department, for the privilege of studying an interesting collection. Finally, a mass of most alluring specimens was received from the Entomological Museum of the University of Kansas, at Lawrence; Milton W. Sanderson negotiating the loan. In addition to the above, Mr. Owen Bryant, of Tucson, Arizona, submitted an abundance of valuable material for identification. Credit for the Melyridae described below will be given in the text. Paratypes of a number of the new forms described are deposited in the collection of the American Entomological Society.

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[1] No. 1. Can. Ent., LIII, pp. 129–132, (June, 1921). No. 2. Pan-Pacif. Ent., III, pp. 163–168, (April, 1927). No. 3. Pan-Pacif. Ent., VI, pp. 21–25, (July, 1929). No. 4. Pan-Pacif., VI, pp. 57–62, (Oct., 1929).

[2] Bul. 63 of the U. S. Nat. Museum.

## Tribe ELEODINI

**Eleodes acuta** Say subsp. **pernigra** new subspecies

*Differential characters.*—From *obscura* Say it is separated by the elytra being quite suddenly inflexed laterally and therefore very narrowly rounded at the sides, the margins acute at the humeri. From *suturalis* Say it is recognized by the pronotal disk being convex and not reflexed laterally.

*Salient type characters.*—Form of *acuta* Say, color deep black, without the reddish sutural area; surface more or less shining and smoother. The elytra of both sexes are usually more convex, especially in the female where the sides are more rounded. In both sexes the elytral striae are more finely punctate and the intervals obsoletely punctulate.

Male: In *pernigra* the form is narrower and more parallel, the abdomen is somewhat oblique to the horizontal plane of the sterna as in *acuta* Say; the elytral margins are more acute and the disk less convex.

Female: Larger, body less parallel and the sides more arcuate; elytra somewhat inflated and therefore more convex, lateral margins less acute to rounded. Abdomen horizontal. evenly and strongly convex.

*Measurements.*—(Types) Length 30 mm.; width 13 to 14 mm.

*Holotype.*—Female; Katherine, Texas; December 3, 1911; [Colln. State Natural History Survey Division, Urbana, Illinois].

*Allotype.*—Male; Sarita, Texas; December 4, 1911; [Deposited as above].

*Paratypes.*—4 ♂, 5 ♀; with same data. Distributed: Colln. State Natural Survey Division of Illinois, 6; Colln. of the author, 1 ♂, 1 ♀; Colln. American Entomological Society, 1 ♂.

### Subgenus **ARPELEODES** new subgenus

The subgenera of the genus *Eleodes* are based chiefly on the primary genital characters, especially those of the female. In *Ardeleodes* these are therefore essential, along with the more or less depressed subovate form and more or less developed tarsal pubescent tufts or pads.

Form moderately elongate oblong-ovate, more or less depressed and subalobatoid in facies. Color black to piceous; luster dull to more or less shining. Protarsi and mesotarsi with tufts or pads of yellowish pubescence on the apices of the segments beneath, varying in the species. The tufts vary in a definite manner on the same tarsus, those of the first and second segments usually larger and entire obliterating the plantar grooves; those of the following segments are smaller and more or less divided on the median line, leaving the plantar grooves more or less entire. On the mesotarsi the tufts are smaller, similar and confined to the apex of the segments, or reduced in number, the tuft of the first segment is always evident. Tufts not flat and varying in compactness. The segments bearing tufts are more or less thickened at apex beneath.

In the female the first segment of the protarsi and mesotarsi may be more or less thickened at apex beneath, a small tuft may or may not be evident; the marginal and apical spinules may be yellowish or blackish and the plantar grooves entire.

Profemora mutic and more or less sinuate at apex beneath; protibiae and mesotibiae more or less constricted at base. Protibial spurs similar in the sexes.

*Genital characters.*—Male: Edeagophore of the usual oblong-ovate depressed form. Female: Genital segment elongately triangulo-parabolic in outline. For the fuller discussion of the primary genital characters of the genotype, see the author's Monograph of the Eleodiini.[3]

GENOTYPE: *Eleodes* (*Blapylis*) *tibialis* Blaisdell.

*Genotype locality.*—Baja California, Mexico.

**Eleodes (Ardeleodes) tibialis** Blaisdell

*Diagnostic characters.*—In the above mentioned Monograph, p. 316, it is stated as follows: "*Tibialis* is a unique and very distinct species in the United States fauna. It could not be recognized among the Mexican species given in the Biologia. Although aberrant it will have to constitute a group in the subgenus *Blapylis*, until more material can be studied; it is not far out of place, as the first joint of the protarsi is clothed with yellow pubescence beneath and the genital characters are more in harmony here than elsewhere. It differs from all other species in its elongate, depressed and subnyctobatoid form; the protibiae are constricted at base in the typical form, but not in the oblong form." *Ardeleodes* is to be placed after *Blapylis* in our lists.

## Subgenus STENELEODES Blaisdell

**Eleodes (Steneleodes) ornatipennis** new species

*Ornatipennis* is a very unique departure from the entirely black color of all the other species. It should follow *longicollis* Lec. in our lists. The tufts of grayish setiform hairs at apices of the first two protarsal segments is quite unusual in the subgenus

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[3] Bul. 63, U. S. Nat. Mus., p. 315, 1909.

Steneleodes. The sharply defined bright red vitta on the suture cannot be due to immaturity as specimens fully chitinized and of deep black color have been seen; some specimens do show evidences of immaturity as in certain other species. The vitta in *ornatipennis* is without doubt the analogue of the diffuse redness observed in other species, but here the redness has become fixed and sharply defined. In all specimens that have the vitta it is entire and without evidence of diffuseness. It is true that the closely related *longicollis* sometimes shows diffuse redness along the suture, but there are also other evidences of general immaturity, especially in dead specimens blown about by the winds in arid regions; similar specimens have been seen of *militaris* Horn, collected in Lower California, Mexico.

I am indebted to the National Museum for the opportunity of studying and describing the allotype. The holotype has been in the author's collection for many years. The paratypes were a loan for study from the Museum of the university of Kansas.

The species in which the diffuse redness occurs in the sutural area of fully chitinized specimens are the following: *Eleodes acuta* Say, *suturalis* Say, *hispilabris* Say and *obsoleta* Say, and in which it varies in all degrees.

Form elongate, subfusiform (nearly as in *longicollis* LeConte) to ovate, about three and one-third times as long as wide. Color black, except a red vitta on the suture extending from the elytral base to apex and not involving the scutellum. Vitta at base is equal in width to the middle two-fourths of the pronotal base; its sides are straight, sharply defined and gradually convergent to the elytral apex. Fifth ventral abdominal segment more or less reddish, even in fully matured specimens; sometimes the fourth segment in less matured individuals. Surface smooth and polished, minutely and sparsely punctured.

Head relatively small, widest across the tempora and twice as wide as long before the post-ocular line; gradually narrowed behind the tempora, the latter noticeably more prominent than the eyes and distinctly more so than sides of the front; frontal suture distinct but not sharply marked, the oblique feeble; sides before the eyes rather broadly arcuate and moderately convergent, thence broadly sinuate with sides of the epistoma, the latter subtruncate at apex, the angles narrowly rounded. Frons slightly convex, very feebly impressed within the very slightly convex supra-antennal convexities, the latter impressed adjacent to the eyes, which are narrowly reniform and comparatively small, nearly flat and the facets very feebly convex; surface rather sparsely and irregularly punctate, punctures shallow and not well defined, stronger and denser at the sides, where each bears a black and anteriorly directed seta. Antennae moderately long, extending to the pronotal base, slender; segments eight to eleven inclusive slightly wider, three to seven inclusive quite equal in width; second segment small and subannular, as long as wide; third elongate and very feebly obconical, four times as long as the second and equal to the fourth and fifth combined; fourth obconical and about twice as long as wide; segments five to seven inclusive equal in length, subconical and not quite twice as long as wide; eight to eleven inclusive slightly compressed, eighth triangular in outline and about as long as wide; ninth and tenth irregularly oval, slightly wider than long; eleventh short obovate, quite as long as wide and slightly oblique at apex.

Pronotum subquadrate a little wider than long, widest a little before the middle; apex truncate to slightly emarginate, angles distinct viewed from above and not in the least prominent; sides feebly arcuate, marginal bead fine; base broadly and moderately arcuate, angles well rounded, about one-eighth wider than apex, the latter about one-third wider than the head; disk strongly and arcuately convex from side to side, finely, sparsely and subobsoletely punctulate.

Elytra a little more than twice as long as wide and a little more than three times as long as the pronotum; base scarcely wider than the pronotal base, humeral angles sharply angulate but not prominent; sides broadly arcuate, converging in apical one-third to the narrowly rounded apex. Disk convex to somewhat flattened, strongly arcuate and declivous laterally with moderate inflexion; surface slightly alutaceous, sparsely punctate, punctures small and more or less feeble.

Abdomen sparsely punctate, punctures small and irregular, surface obsoletely rugulose. Legs moderately long, tarsi moderate in length and slenderness. Metatarsi about two-thirds as long as their tibia. Femora not inflated, tibiae at times slightly arcuate.

Male: Narrower and subfusiform. Elytra widest at middle, less convex or not. Protarsi with apical tufts of moderately long setiform hairs at apex beneath which are grayish or blackish in color, closing the plantar grooves on segments one and two, which are thickened at apex beneath. Abdomen feebly convex and somewhat impressed along middle third on first three segments.

Female: Somewhat fusiform-ovate. Elytra widest at or slightly behind the middle and more or less convex. Abdomen moderately convex. Plantar grooves entire, except slightly obstructed at apex of segments one and two, by a tuft of longer spinules, narrowly divided on the median line.

*Measurements.*—(Types) Length 22 to 27 mm.; width 8 to 8.5 mm.

*Holotype.*—Female; New Mexico; (F. H. Snow); [Author's collection, Museum of the California Academy of Sciences, no. 4328]. Obtained by exchange in the 1980's.

*Allotype.*—Male; near the Papagochic River, Guerrero, Chiricahua, Mexico; (W. F. Foshag; 1934); [U. S. National Museum, Washington].

*Paratype.*—Two ♀; same data as holotype; [University of Kansas].

### Subgenus **HOLELEODES** new subgenus

The species of *Holeleodes* are distinguished from those of the Subgenus *Steneleodes,* by the presence of well developed pads or tufts of pubescence on the under surface of the protarsi and mesotarsi. The primary genital characters indicate that *Holeleodes* should follow *Steneleodes* in our lists.

Form elongate subfusiform to subovate, facies resembling that of a small *Eleodes* (*Steneleodes*) *longicollis* LeConte. Elytra somewhat depressed to moderately convex. Color black, surface more or less polished, punctation fine, not muricate. Profemora mutic, briefly sinuate beneath at apex.

Protarsi and mesotarsi of the male with three or four segments thickened at apex beneath and clothed with tufts of golden or fulvous pubescence; the tufts truncate and flat or with the hairs longer and less compact, more or less completely obliterating the plantar grooves. In the female the first two segments of the protarsi are less thickened beneath at apex and with apical tufts of yellowish or black spinules, obliterating the grooves. Primary genital characters show relationship with *Steneleodes,* which it should follow in our lists.

GENOTYPE: *Eleodes beameri* Blaisdell new species.

*Genotype localities.*—Huachuca and Chiricahua Mountains, Arizona.

### **Eleodes (Holeleodes) beameri** new species

Form elongate, subfusiform to subovate, facies of a small *longicollis* LeConte or a *gentilis* LeConte, a little more than three times as long as wide. Color deep black, faintly alutaceous; surface smooth and not in the least muricate.

Head relatively somewhat large, about twice as wide as long before the post-ocular line, equally wide across the tempora and sides of the front, eyes slightly less prominent; sides arcuately convergent anteriorly, broadly and feebly emarginate across the position of the oblique sutures; epistomal apex broadly and slightly emarginate, angles rounded. Frons feebly convex to plane, impressions and sutures obsolescent, rather sparsely punctate, punctures small and shallow.

Antennae moderately long, attaining the base of the pronotum when the head is retracted to the tempora, moderately slender and similar in the sexes; last or distal four segments slightly compressed and a little wider than the preceding segments; second segment annular, nearly as long as wide; third elongate, quite cylindrical, three and one-half times as long as the second and at apex as wide as the fourth to the sixth inclusive, these being one-third longer than wide; seventh conico-triangular, as long as the sixth and about one-fourth wider; segments eight, nine and ten equal in length exclusive of the condyles, eighth triangular, as long as wide and one-fourth wider than the seventh; segments nine and ten spherical, equal in length and width, one-sixth wider than the eighth; eleventh short subconico-spherical, subacute at apex and as long as wide, about one-third longer than and equal in width to the tenth.

Pronotum subquadrate, a little wider than long, widest at middle and about one-sixth wider than the head; apex truncato-emarginate, angles narrowly rounded and not at all prominent; sides broadly arcuate in middle third, less so and slightly convergent anteriorly, straighter, convergent and rather feebly and broadly sinuate posteriorly to the obtuse angles, the latter not prominent; base broadly and not strongly arcuate, slightly wider than the apex, marginal bead rather wide and flat; disk evenly convex and noticeably declivous laterally, very minutely, sparsely and evenly punctate.

Elytra about twice as long as wide, two and one-fourth times as long as the pronotum; base scarcely wider than the pronotal base, humeri blunt and not in the least prominent; sides broadly and moderately arcuate, less so in apical fourth and convergent to the rather narrowly rounded apex. Disk less than moderately convex in the central area, laterally strongly and arcuately declivous with moderate inflexion; gradually and arcuately declivous in apical one-fourth; punctures very small, sparse, shallow and evenly placed throughout. Scutellum transverse, short and evenly arcuate at apex.

Abdomen finely, sparsely and evenly punctulate, feebly and loosely creased. First segment behind the coxae equal in length to the fifth and a little shorter than the second; on the median line about one-seventh of its length longer than the combined lengths of the third and fourth segments; third about one-fifth longer than the fourth. Legs moderate in length and rather slender.

Male: Narrower. Elytra more or less depressed to moderately convex. Abdomen moderately convex, flattened on middle third of first three segments. First four segments of the protarsi with flat dense pubescent pads, fulvous in color on apical two-thirds beneath and gradually diminishing in size from the first; plantar grooves absent on the first segment, poorly defined in basal third on the second, third and fourth, distinct on the fifth. Mesotarsi with similar but smaller pads on apical one-half of first three segments; plantar grooves distinct in basal one-half of second and third segments, obliterated on the first and distinct and entire on fourth and fifth segments.

Female: Broader. Elytra more convex, widest at or just behind the middle, somewhat inflated. Abdomen moderately convex. First three segments of the protarsi with apical tufts, black or slightly fulvous at apex and the plantar grooves absent. On the mesotarsi the apical tufts are more or less divided and the plantar grooves open.

*Measurements.*—(Types) Length 18 to 20 mm.; width 7 to 9 mm.

*Holotype.*—Male; Huachuca Mountains, Arizona; (P. A. Readio); [Colln. University of Kansas].

*Allotype.*—Female; Chiricahua Mountains, Arizona; July 8, 1932; (R. H. Beamer); [Colln. Univ. of Kansas].

*Paratypes.*—6 ♂, 3 ♀; with same data. Distributed: author's collection, 2 ♂; Colln. American Entomological Society 2 ♂; Colln. University of Kansas, 5.

With *beameri* in the subgenus *Holeleodes* also belong *bryanti*, *palmerleensis* and other species in Mexico.

**Eleodes (Holeleodes) bryanti** new species

*Bryanti* differs distinctly from *beameri* in the character of the pubescent pads or tufts of the protarsi and mesotarsi. In *beameri* the pubescence of the pads is shorter and the apical surface is flat or truncate; in *bryanti* the tufts are less compact, the hairs longer, the surfaces not truncate but formed by the irregular grouping of the hairs. In *beameri* the pronotal sides are most strongly arcuate in middle third, thence less arcuate and convergent to apex; posteriorly the sides are nearly straight and broadly, feebly sinuate to the basal angles.

It is very probable that the following Mexican species are to be associated with *beameri: Forreri* Champion, *laevigata* Solier, *solieri* Champion, *olida* Champion, *tenebricosa* Gemm. and *hepburni* Champion?

Form elongate subfusiform to subovate, about two and one-half times as long as wide. Color deep black, surface smooth, polished and not in the least muricate, punctures small, sparse and simple.

Head slightly widest across the oculo-temporal junction, slightly more than twice as wide as long before the postocular line; sides before the eyes arcuate and moderately convergent to the oblique sutures, being broadly emarginate with the straight and convergent sides of the epistoma; apex of the latter broadly and slightly emarginate, angles well rounded; labrum briefly and rather deeply emarginate at middle of apex, thence with the sides strongly arcuate; frons quite plane, broadly and feebly impressed within the slightly convex supra-antennal convexities, punctures of the central area small and sparse, a little larger and less sparse laterally and on the epistoma, oblique sutures more or less evident, the frontal feeble to obsolescent; tempora and sides of occiput gradually convergent posteriorly. Antennae moderate in length, attaining the pronotal base, slender, distal four segments slightly wider than the preceding and feebly compressed; segments five to seven inclusive equal in width and length, about two-fifths longer than wide and somewhat obconico-cylindrical, fourth rather cylindrical and twice as long as wide; first segment stout, second annular, short and as long as wide; third elongate, very feebly obconical, four and one-half times as long as the second and twice as long as the fourth; eighth subspherical and a little longer than wide, ninth and tenth spherical, as long as wide; eleventh irregularly oval, little longer than wide and somewhat obliquely truncate at apex.

Pronotum about one-sixth wider than long, widest at middle; base quite equal in width to the length and a little wider than the apex, the latter about one-fourth wider than the head, arcuato-truncate and slightly sinuate within the angles, the latter obtuse and not in the least prominent; sides broadly and somewhat strongly arcuate, slightly less so posteriorly and feebly sinuate before the distinct and obtuse angles; base very broadly and less than moderately arcuate, marginal bead rather wide and flat; disk rather strongly and evenly convex, finely, sparsely and evenly punctate.

Elytra about a little less than twice as long as wide and almost three times as long as the pronotum; base feebly emarginate, scarcely wider than the pronotal base, humeri obtuse and not in the least prominent; sides broadly arcuate, more convergent in apical fourth to the rather narrowly rounded apex. Disk more or less convex, varying in the sexes, strongly arcuate and declivous laterally and rather rapidly inflexed; arcuately and somewhat gradually declivous in apical fourth; surface finely, sparsely and rather evenly punctate, microscopically granulate and with fine and obsolescent creases.

Abdomen finely and sparsely punctate. First segment on the median line quite equal in length to that of the fourth and fifth combined, behind the coxae equal in length to the third, the latter equal to the fifth and one-fourth longer than the fourth. Legs rather more than moderate in length and moderate in stoutness. Metatibiae about one-seventh shorter than their femur. Metatarsi two-thirds as long as their tibiae; first segment as long as the fourth and equal to the combined lengths of the second and third, the latter equal to each other. Protarsi and mesotarsi with golden-yellow pubescent tufts beneath.

Male: Form narrower and somewhat fusiform. Elytra more or less noticeably depressed to moderately convex, widest at middle. Abdomen less convex and more or less impressed in middle third of first three segments. First four segments of the protarsi with golden-yellow pubescent tufts beneath, the hairs are longer than in *beameri* and not truncate at apex; the segments are short, thickened beneath and the plantar grooves obliterated, groove of the fifth segment normal; tuft more apical on each fourth segment and more or less divided on the median line. Tufts of the first three segments of the mesotarsi at apical one-half; those of the third and fourth segments are divided on the median line, with the plantar grooves distinct; groove of the fifth segment normal; tufts smaller and looser than on the protarsi.

Female: Form wider and more ovate. Elytra more strongly convex, slightly inflated at times, usually widest just behind the middle. Abdomen moderately convex. Protarsal segments one and two with small apical tuft of blackish or yellowish spinules or coarse hairs, closing the plantar grooves; the apical tufts of the third and fourth segments are blackish, divided and the grooves not obliterated, those of the fifth segment normal. The plantar grooves of the mesotarsi are distinct, although the first groove may be closed at apex by blackish spinules.

*Measurements.*—(Types) Length 20 to 23 mm.; width 8 to 9 mm.

*Holotype.*—Female; Graham Mountains, Arizona; August 12, 1933; (Owen Bryant); [Author's collection, Cal. Acad. Sci., no. 4329].

*Allotype.*—Male; with same locality; July 26, 1923; (Frank H. Parker); [Author's colln., Cal. Acad. Aci., no. 4330].

*Paratypes.*—3 ♂, 4 ♀; with same data. Distributed: Author's collection, 1 ♂, 1 ♀; Colln. American Entomological Society, 1 ♂, 1 ♀; Colln. Mr. Bryant, 1 ♂, 2 ♀.

**Eleodes (Holeleodes) palmerleensis** new species

This species has thicker integuments than either *beameri* or *bryanti*. The genital segment of the holotype is exposed and shows that the subgenus *Holeleodes* is related to *Steneleodes*. The types have been in the author's collection for about twenty-five years, waiting for others to be found and definitely settle the question of relationship.

Form elongate suboblong-oval to elongate subovate, about three times as long as wide. Color deep black. Surface smooth, finely alutaceous, body not in the least muricate. Luster shining to somewhat dull. Protarsi and mesotarsi with tufts of fulvous hairs beneath.

Head subequally widest across the temporo-ocular junction and sides of the frons, twice as wide as long before the post-ocular line, labrum not included; sides before the eyes moderately arcuate and converging to the position of the oblique sutures, there broadly and feebly emarginate with the straight and converging sides of the epistoma; the latter broadly and rather feebly emarginate at apex, the angles slightly obtuse; labrum briefly and rather deeply emarginate at middle of apex, thence with the sides almost semi-circularly arcuate to base. Frons slightly convex, broadly and feebly impressed within the less than moderately convex supra-antennal convexities, oblique and frontal sutures fine and more or less evident; surface finely, irregularly punctate, punctures separated by a distance equal to one or twice their diameter, gradually larger and denser laterally and on the epistoma. Antennae moderate in length, about attaining the pronotal base, slightly stouter than in *beameri;* segments eight to eleven inclusive moderately compressed and slightly wider than the preceding; four to seven inclusive subequal in length and width, one-half longer than wide and subobconico-suboval in outline; second segment short, as long as wide, annular; third elongate, about three times as long as wide and four times as long as the second; eighth triangulo-subspherical and slightly larger than the seventh, ninth spherical and slightly wider than long, tenth slightly transverse and feebly, irregularly subovate, equal in width to the ninth; eleventh short obovate, a little longer than wide and subtruncate at apex.

Pronotum subquadrate, widest just in advance of the middle, apex truncato-emarginate, margin beaded, angles narrowly obtuse and not prominent; sides broadly arcuate in anterior two-thirds, more convergent and straighter toward base and slightly, broadly subsinuate, marginal bead fine; base truncato-arcuate, angles moderately rounded; basal bead broad and flat, obsolete in about middle third. Disk strongly convex from side to side, marginal bead not visible from above, very finely and sparsely punctate.

Elytra about twice as long as wide, two and one-half times as long as the pronotum; base feebly emarginate, not wider than the pronotal base to which it is adapted, humeri obsolete; sides broadly and less than moderately arcuate to the rather narrowly rounded apex. Disk less than moderately convex, strongly arcuate and declivous laterally with moderate inflexion; evenly and arcuately declivous in apical third; surface very finely and somewhat sparsely punctate, obsoletely and irregularly creased.

Abdomen finely and sparsely punctate. Legs moderate in length and stoutness; profemora distinctly sinuate beneath in about fourth; protibiae cylindrically constricted in basal sixth, thence rather abruptly parallel to apex. First segment on the median line a little longer than the combined lengths of second and third; behind the coxae equal to the length of the third and one-fourth longer than the fourth; second about one-fourth longer than the fifth. Each metatibia one-third of its length shorter than its femur. Metatarsi two-thirds as long as their tibia; first and fourth segments equal in length, second and third combined not quite as long as the fourth; second one-third longer than the third.

Male: Narrower in form. Elytra at middle scarcely wider than the pronotum. Legs somewhat stouter, profemoral apical sinuation stronger, thence more abruptly widened and almost subdentate; basal constriction of the protibiae as in the female. Protarsal segments one to three inclusive distinctly thickened at apex beneath; pubescent tufts rather loose and a little longer, obliterating the plantar grooves; tuft of the fourth segment divided on the median line, groove short but evident; groove of the fifth entire. Segments of the mesotarsi less thickened beneath; tuft of first segment entire, those of the second, third and fourth segments apical, smaller and divided on the median line, grooves distinct. Abdomen moderately convex and flattened in middle third of first three segments.

Female: Larger and stouter. Elytra widest behind the middle and distinctly wider than the pronotum; sides more strongly arcuate. Abdomen more convex and horizontal. Legs less stout, especially the anterior and the tarsi more slender; profemoral apical sinuation less strong and the protibial basal constriction as in the male. First two segments of the protarsi more or less thickened at apex beneath and with tufts of spinules obliterating the grooves; on segments three and four the apical spinules are divided on the median line and the grooves normal. Mesotarsal grooves and apical spinules normal.

*Measurements.*—(Types) Length 21 to 24 mm.; width 7 to 8.5 mm.

*Holotype.* — Female; near Palmerlee, Arizona: (Mr. Harry Wenzel, Sr.), [Author's collection, California Academy of Sciences; no. 4331].

No paratypes.

*Allotype.*—Male; with same data; [Col. Acad. Sci., Author's colln.; no. 4332].

## MELYRIDAE

**Eudasytes sinuatus** new species

*Sinuatus* can be quickly recognized from all the other members of the genus, by the sinuate sides of the pronotum behind the apical angles; the epipleurae are horizontal and the inner margins are distinct to the elytral apex.

Male: Form oblong-oval, about two and one-fifth times as long as wide. Color black; femora rufo-testaceous, tibiae, tarsi and antennae dark rufo-testaceous to slightly suffused with piceous. Luster more or less shining, elytra least so. Pubescence pale, moderate in length, not coarse, moderately dense but not obscuring the surface, somewhat less abundant on the pronotum; on the ventral surface finer and appressed, most noticeable on the apices of the segments; elytra with sparsely placed, nearly erect pale setiform hairs, those of the pronotum darker, finer, shorter and inconspicuous.

Head relatively small, widest across the eyes, about two-fifths wider than long before the post-ocular line; frons moderately convex, vertex strongly so, finely and rather densely punctate; articulating membrane and labrum dark, the latter relatively small. Eyes large and prominent, somewhat oval, facets small, slightly convex and numerous. Antennae stout, in length equal to that of the pronotum, segments largest beyond the third, very gradually and slightly increasing in width; segments four to ten inclusive equal in length and obtusely prominent anteriorly; fourth, sixth and seventh about equal in width; fifth, eighth and ninth gradually a little wider than long, tenth widest; eleventh oval, a little more than one-half longer than wide and not as wide as the tenth; segment three obconical and two and one-half times as long as wide at apex; second stouter, obconical and a little longer than wide, first suboval and rather robust.

Pronotum about one-fourth wider than long, base and apex quite equal in width, the latter truncato-arcuate, marginal bead not strong, angles large and prominent antero-laterally, rather broad and evenly rounded; sides rather strongly sinuate behind the angles, thence broadly arcuate, becoming more or less distinctly sinuate before the base, margin irregularly subserrulate; basal angles almost right, moderately prominent and subacute; base moderately arcuate in middle two-fourths, becoming broadly and feebly sinuate laterally, marginal bead distinct. Disk moderately and evenly convex, impressed at the angles, especially the apical, lateral submarginal impression linear, bead not strong; punctures rather sharply defined, a little larger than on the frons, separated in the central area by a distance equal to two or three times their diameter, a little larger laterally and slightly denser.

Elytra widest across the rather large and well rounded humeri, about one-half longer than wide and a little more than twice as long as the pronotum; base broadly emarginate; sides parallel, straight and a little convergent to apical fourth, thence gradually and evenly arcuate to the obtusely rounded sutural angles, apices dehiscent at the suture. Disk somewhat flat and slightly convex, feebly impressed within the rather large humeral umbones; sides arcuately declivous to the rather narrow and flat margins, which are distinctly finely serrulate throughout to the apex. The tumid humeri cause the declivous sides to appear broadly sinuate in the middle two-fourths of the elytral length, the margin being visible from above. Punctation rather dense, punctures small and the surface somewhat finely and transversely rugulose. Scutellum subquadrate, apex slightly arcuate and feebly impressed opposite the elytral suture.

Abdomen moderately convex, finely and densely punctate; fifth ventral segment truncato-sinuate at apex. Legs moderately short and somewhat slender; metatibiae equal in length to the metafemora; metatarsi nearly three-fourths as long as their tibia.

*Measurements.*—(Type) Length 3.5 mm.; width 1.8 mm.

*Holotype.*—Male; Yermo, San Bernardino County, California; May 28, 1935; (Otis); [Author's collection, Cal. Acad. Sci., no. 4333].

*Paratypes.*—2 ♂; with same data. Distributed: Colln. American Entomological Society, 1; Colln. Agricultural Quarantine Station, San Francisco, 1.

All types recorded under I-142 and E-19, in the above Quarantine Station. The author is indebted to Mr. P. C. Ting for the specimens.

**Trichochrous cupripilosa** new species

This species is apparently very distinct. According to Casey's synoptic table the species is to be associated with *fulvitarsis* Bland, *discipulus* Casey and *caseyi* Champ. (*femoralis* Casey), all of which have the legs more or less pale; by the color of the pubescence it might be referred to *fulvescens* Casey, which has piceo-testaceous legs and besides the fulvous hairs are "intermixed with numerous long bristling setae, blackish in color." In *cupripilosa* the legs are deep black and the pubescence is irregularly subrecumbent.

Male: Form parallel oblong-oval, about two and one-half times as long as wide. Color black. Pubescence of superior surface rather coarse, moderate in length and somewhat semierect, dense but not completely obscuring the surface and cupreous to pale flavate in color; black or erect setiform hairs entirely absent. Lateral pronotal fimbriae moderate in length, regular and recurved upward and backward; the hairs of the apical margin slightly coarser and inwardly curved from each side over the margin to center. Elytral fimbriae less closely placed, longer and regular. Hairs of the under surface of body, finer, moderate in length, appressed to the surface and plumbeo-cinereous in color.

Head moderately small, widest across the eyes, about two-thirds as wide as the pronotum; muzzle equal to one-half of the length before the postocular line. Frons slightly convex, shining, finely and not closely punctate. Eyes large, evenly convex, facets small and numerous. Antennae less than moderately stout, quite as long as the width of pronotal apex; segments three to seven inclusive feebly serrate anteriorly; first segment stout, second subglobular and equal in length to the fifth, fourth very slightly longer and subobconical, fifth a little larger, sixth and seventh slightly transverse, eighth to the tenth inclusive slightly incrassate and subquadrate; eleventh oval and twice as long as wide.

Pronotum transverse less than one-half wider than long; apex arcuato-truncate in moderate circular arc, angles more or less moderately rounded; sides feebly arcuate, parallel, very feebly and rather broadly sinuate before the obtuse basal angles, margin finely serrulate; base a little wider than apex, quite broadly lobed and distinctly sinuate in lateral sixths; disk evenly convex, finely and not closely punctate.

Elytra long, one-half longer than wide and about two and one-half times as long as the pronotum and a little wider; base broadly sinuate in middle two-fourths, humeri rounded; sides parallel, feebly arcuate, most so in apical fourth, apices separately rounded, slightly emarginate at the suture, margins finely serrulate; disk feebly convex becoming arcuately declivous laterally, punctures small and not densely placed. Scutellum subquadrate. Under surface of body very finely and quite densely punctate. Fifth abdominal segment truncate at apex. Femora not stout, the metafemora about attaining the apex of the third abdominal segment. Metatarsi not quite as long as their tibia.

Female: Usually larger. Pronotum more transverse and one-half wider than long, base about one-fourth wider than apex. Antennae not serrate anteriorly, more slender with the distal three segments slightly stouter. Elytra about three-fourths longer than wide and nearly three times as long as the pronotum. Fifth abdominal ventral segment longer and rounded at apex.

*Measurements.*—(Types) Length 2 to 3 mm.; width .8 to 1.2 mm.

*Holotype.*—Male; Buckman's Springs, San Diego County, California; June 6, 1928; (C. C. Searl; on thistle and *Adenostoma* blossoms); [Author's collection, Cal. Acad. Sci., no. 4334].

*Allotype.*—Female; with same data; [Cal. Acad. Sci., no. 4335].

*Paratypes.*—14 ♂, 9 ♀; with same data. Distributed: Author's collection, 7; Colln. American Entomological Society, 6; Colln. Natural History Museum, Balboa Park, San Diego, California, 12.

The author is indebted to Mr. Ian Moore and Mr. Albert O. Watson for the loan of specimens from the collection of the Natural History Museum.

**Listrus wyomingensis** new species

This species differs from all of the others that have been described, by its habitat, and more irregular and less defined maculation. It is separated from *robustus*, a companion species, by being less robust and by the pronotal sculpturing. In *robustus* the pronotal punctation is discrete, comparatively coarse and well defined; the intervening surface is smooth and besides the areas of dark pubescence of the elytra, are larger and not well defined; in both species the color and pubescence are very similar. In *interruptus* LeConte the fifth ventral abdominal segment of the male is modified.

Form elongate, subovate, about two and three-fourths times as long as wide. Color black, except that the tibiae distally, tarsi and antennae, are nigro-piceous to slightly paler; third and fourth segments of the antennae usually pale. Luster moderately shining, slightly aeneo-purpurescent but variable. Pubescence not dense, rather coarse, moderate in length, subrecumbent but not appressed to the surface; pale flavate in color, that of the maculae brown to blackish; on the under surface of body ashy and appressed to the surface. Maculae rather large and more or less indefinitely defined; on each elytron when discernable consisting of a parasutural just behind the scutellum, one at middle third and about middle of the elytron; two more or less incomplete fasciae, neither entire, one slightly oblique at about middle, the other posterior and transverse, both more or less constricted at middle, attaining the margin laterally, interrupted at the suture and there enlarged.

Head widest across the eyes, the width greater than that of the pronotal apex and twice as wide as long before the post-ocular line; frons scarcely convex, rather broadly but not deeply impressed laterally from the base of the connate epistoma, sutures obliterated; surface densely indentato-punctate, punctures small. Antennae quite similar in the sexes, rather slender and moderate in length, about attaining the pronotal base, moderately compressed beyond the third segment; second segment subglobular but longer than wide, third slender and obconical, twice as long as wide; segments four to ten inclusive subtriangular and quite equal in length, except the eighth which is somewhat smaller; in both sexes the eleventh segment is largest, oval to slightly ovate, about a third longer than wide and equal to the combined lengths of segments five and six. Eyes slightly oval and very prominent, facets small.

Pronotum a little wider than long, similar in the sexes; apex slightly arcuato-truncate, angles rounded; sides slightly convergent anteriorly, evenly arcuate, continuously so with the broadly arcuate base; or the latter very feebly sinuate in lateral sixths and the angles slightly indicated, about one-fourth wider than the apex. Lateral margins serrulate and the fimbriae short and whitish. Disk rather strongly convex and densely indentato-punctate.

Elytra twice as long as wide, a little more than three times as long as the pronotum; base more or less broadly emarginate; sides parallel; apex parabolically rounded, feebly emarginate at the sutures with the angles rounded. Disk moderately strongly convex, less so toward base, humeri rather narrowly rounded, umbones small, the surface slightly impressed within; sides at and just behind the humeri abruptly precipitous, thence gardually arcuately declivous as at apex; surface rather densely punctate, punctures small, distinct, separated by a distance equal to a little more than their own diameter and the intervals slightly uneven. Scutellum small, rounded at apex, not invested with whitish hairs.

Abdomen feebly convex, second segment as long as the fifth, third and fourth quite equal in length. Legs short, the metafemora straight, and not in the least inflated.

Male: Narrower and rather shorter than the female. Antennal segments beyond the sixth wider, more equal in width and more subserrate anteriorly. Apex of the fifth ventral abdominal segment quite broadly but not deeply sinuate, the depth of the sinus about equal to one-fifth of the length; not modified on the disk.

Female: Usually longer and slightly wider behind the middle. Antennal segments seven to ten inclusive not as wide as the fifth or sixth, the latter slightly subserrate anteriorly, eighth smallest. (*Vide supra* for characters common to both sexes.)

*Measurements.*—(Types) Length 3 to 3.5 mm.; width 1 to 1.3 mm.

*Holotype.*—Male; Grand Teton Peak, Wyoming; July 1936; (John E. Blum); [Author's collection, Cal. Acad. Sci., no. 4336].

*Allotype.*—Female; with same data; [Col. Acad. Sci., no. 4337].

*Paratypes.*—4 ♂, 5 ♀, with same data. Distributed: Author's collection, 2; Colln. Mr. Blum, 5; Colln. American Entomological Society, 2.

**Listrus robustus** new species

*Robustus* is unique among the known species because of its rather stout form, coarse, discrete and subperforate punctation of the pronotal disk within the central area, and dense, asperate sculpturing laterally; the elytral maculae are large and indefinite, limited by the paler hairs as stated below. The companion species, *wyomingensis* is similar in its pubescence and maculation, and has the pronotal disk very densely indentato-punctate. *Listrus interruptus* LeConte has the secondary sexual characters well defined; the fifth ventral abdominal segment being modified on the disk at apex. In *robustus* the secondary characters are very poorly developed.

Form somewhat robust, slightly ovate, about two and one-half times as long as wide. Color black, tarsi and segments two and three of antennae more or less piceous. Luster dull, feebly aeneous. Pubescence not dense, surface well exposed; pale yellowish hairs of the elytra rather coarse, at the periphery and in an oblique line extending outward from the scutellum to the margin at middle as well as along the suture to the apex; maculae of recumbent and finer dark brown hairs, without definite limits; pronotum and head with similar arrangement of the pale and brownish hairs. Lateral fimbriae of the pronotum and elytra not very close set and grayish in color. Pubescence of the under surface of body recumbent and ashy in color, moderately dense, less so and not conspicuous on the sterna.

Head widest across the eyes, wider than long before the post-ocular line, muzzle moderately short; frons somewhat convex, feebly and rather broadly impressed laterally within the sides; epistoma connate with the frons, sutures obliterated, a feeble, rounded and smooth umbone at middle against its base; labrum truncate at apex. Surface rather sparsely punctate, punctures smaller than on the pronotum, distinct and well defined, separated by a distance equal to one or two times their diameter. Eyes rather small, strongly convex and prominent. Antennae moderately dissimilar in the sexes, in length about attaining the pronotal base and about equal in length to the pronotal width; first segment stout and subquadrate viewed from above exclusive of the condyle; second oval and scarcely longer than wide; third smallest, slender, subcylindrical to subconical and scarcely twice as long as wide; eleventh elongate oval, twice as long as wide and equal in length to the ninth and tenth taken together (*vide infra* under sexes).

Pronotum one-fourth wider than long, apex arcuato-truncate in moderate circular arc, angles broadly rounded; sides moderately arcuate, noticeably convergent anteriorly, margin serrulate, serrules rounded rather than acute; base broadly but not strongly arcuate, slightly and briefly sinuate laterally within the last serrule that marks the angles, otherwise obtusely rounded. Disk strongly and evenly convex, slightly impressed at the basal sinuations, coarsely, discretely and subperforately punctate, punctures separated by a distance equal to one or two times their diameter, intervals smooth and shining; punctures closer and the surface scabrous and duller laterally.

Elytra parallel to slightly wider behind the middle, one-half longer than wide; sides broadly and rather feebly arcuate, apex subparabolically rounded, sutural angles obtuse; base arcuately emarginate and adapted to the pronotal base, humeri rather prominent and rounded. Disk strongly convex, less so in basal one-half, arcuate and gradually declivous apically, as well as laterally in posterior one-half; abruptly declivous at and just behind the humeri, marginal fimbriae short; surface coarsely punctate as on the pronotum, punctures well defined and separated by a distance equal to one or two times their diameter; intervals rather smooth and shining with moderate evidence of slight irregularities, a fine parasutural stria is present, especially on the apical declivity of each elytron. Scutellum rather transverse, truncato-sinuate at apex, angles narrowly rounded.

Abdomen moderately convex, finely and rather densely punctate, especially on the fifth segment; pygidium margined with somewhat long bristling blackish hairs. Legs rather short; femora narrow, not in the least inflated; metatibiae as long as femur and trochanter.

Male: Rather more parallel. Antennae somewhat stouter, segments four to ten inclusive more triangular and quite equal in width and length; fifth slightly largest and more prominent before the middle anteriorly; fourth particularly triangular with sides converging from apex to base. Fifth ventral abdominal segment slightly shorter and less arcuate at apex.

Female: Less parallel. Antennae rather slender, segments four to ten inclusive rather triangulo-oval and more suddenly constricted basally; fifth longer, more triangular anteriorly in apical three-fourths and quite petiolated basally; fourth rather oval in apical three-fourths and rather suddenly constricted basally; eighth somewhat swollen or more rounded anteriorly. Fifth ventral somewhat longer and more arcuate at apex.

*Measurements.*—(Types) Male: Length 3.75 mm.; width 1.5 mm. Female: Length 3.5 mm.; width 1.4 mm.

*Holotype.*—Male; Grand Teton Peak, Wyoming; July 1936; (John E. Blum); [Author's collection, Cal. Acad. Sci., no. 4338].

*Allotype.*—Female; with same data; [Cal. Acad. Sci., no. 4339].

*Paratypes.*—6 ♀; with same data. Distributed: Author's collection, 1; Colln. Mr. Blum, 3; Colln. American Entomological Society, 1; Colln., Dr. E. C. Van Dyke, collected at Homestead Inn, Mt. Hood, Oregon, July 3, 1927, 1.

# NEW GENERA AND SPECIES OF THE MELANOPLI FOUND WITHIN THE UNITED STATES AND CANADA

## (ORTHOPTERA: ACRIDIDAE)

## PARTS X TO XIV

BY MORGAN HEBARD

(Plates X and XI)

In completing the arrangement of the brachypterous species of the genus *Melanoplus* three new species and a new geographic race have been located. In order to consider these properly, I have treated here the Mancus and Texanus Groups and have included supplements to my studies of the Femur-nigrum and Indigens Groups already completed in the present series of papers,[1] while a brief review of the Saltator Group is given in order to clear up the existing confusion.

My work on the North American Melanopli began in 1917 and the first contribution to the present series appeared the following year. Including the present paper, two new genera, fifty-six species and fifteen subspecies of this category will have been described. Two species only, *Melanoplus foxi* and *Melanoplus beameri* have been treated outside this series and one of the species has been synonymized.

In the first sections only new species or races were considered, but later all the species of the Groups involved have in many cases been included in order to gain greater clarity. I would here reiterate my statements, made in 1919, that Scudder's grouping of many of the forms has been found incorrect and that, particularly in the genus *Melanoplus*, his " Series " are in so many cases composed of widely separated species that a complete rearrangement was found necessary. I had therefore rearranged the species of *Melanoplus* into " Groups ", these " Groups " not in any way corresponding to Scudder's

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[1] The first of these the second section of part VI, Trans. Amer. Ent. Soc., LX, p. 368, (1935) and the second of these part VII, Trans. Amer. Ent. Soc., LXII, p. 168, (1936).

"Series" and a different specific name being proposed for each "Group" wherever confusion might otherwise occur.

Unless otherwise noted, the material here recorded is in the author's collection.

## PART X. THE SALTATOR GROUP OF THE GENUS MELANOPLUS

So variable are the forms of this group that much confusion in recognizing the valid species and races has occurred. Although still undescribed species and races may exist, I do not feel that any can safely be described at the present time. The present study is therefore not intended to be as complete as those on other groups of the genus and is undertaken only because it is imperative to correct the numerous errors which have occurred and to give all information available which can help to avoid further mistakes. As a result I am here listing only localities and number of specimens, leaving the date, elevation, collector, environmental data and key to be given later in a more finished study at a time when sufficient additional material has been secured to solve several situations which at present are very baffling.

Additional material is particularly needed from southwestern Washington, the Cascades in that State and in Oregon and from the valleys toward and in the western foothills of those mountains. The few specimens before me from those regions are variously atypic from the recognizable species and races and their true significance can probably be determined only after adequate series from a considerable number of localities throughout that extensive territory have been studied.

It is, however, possible at the present time to define the limits of the valid species and races already described much more satisfactorily than has hitherto been possible and to publish all of the existing synonymy.

The features shown by the male supra-anal plate, cerci and subgenital plate must be handled with particular care, differences which in most groups would warrant racial recognition being here plainly attributable to local variation, occurring more frequently than in almost any other group of the Melanopli.

The penis may sometimes appear to be of a strikingly distinctive type when such is actually not at all the case. Normally (except in *ascensus calapooyae*) the cochleate dorsal lobes of this organ stand erect, with their convex surfaces attingent and their concave surfaces directed laterad, embracing the acute apices of the ectoparameres. For some reason rotation has apparently taken place in a very few specimens (two of three males of *saltator* from Crabtree, Oregon, and three males of atypic *ascensus ascensus* from Satus Pass and Cliffdell, Washington) and in these the dorsal lobes have moved in such a way that their (normally) cephalic margins are attingent and mesad, their concave surfaces facing cephalad (similarly embracing the apices of the ectoparameres) and their convex surfaces facing caudad. Strange to say, this is the normal position for these lobes in *ascensus calapooyae.*

At present I feel that two species should be recognized, one of which divides into three geographic races.

**Melanoplus saltator** Scudder (Pl. X, fig. 1.)

1897. *Melanoplus saltator* Scudder (in part), Proc. U. S. Nat. Mus., xx, p. 261, pl. 17, fig. 8. [♂, ♀: Portland (type locality) and Oregon City, Oregon.[2]]

The synonymy of *M. algidus* Scudder, described from Mary's Peak, Oregon, was established by Fulton in 1930. Material of this species was incorrectly recorded in the series described as *ascensus* and as *validus* by Scudder in 1899.

The following material is before me.

OREGON: Portland, 5♂, 2♀. Council Crest near Portland, 18♂, 13♀, 3 juv. ♀. Mount Tabor, 3♂, 3♀. Clackamas, 1♂, 2♀. Forest Grove, 26♂, 18♀. Salem, 19♂, 5♀. Turner, 3♂. Crabtree, 3♂. West Albany, 7♂, 5♀. Corvallis, 3♂. Philomath, 2♂. Mary's Peak, 25♂, 4♀. Alsea Mountain, 1♀. Eugene, 4♂, 2♀.

In these specimens the caudal tibiae are dull bluish glaucous to buffy in the males, the same or pink in the females. The more sudden and more decided marginal convexity distad on each side of the male supra-anal plate and the slenderness of the erect projecting portions of the penis particularly distinguish *saltator*.

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[2] The male from Soda Springs, Washington, is here discussed under the atypic material of *ascensus ascensus*. The female from Loon Lake, Washington, was placed under *indigens digitifer* with a query though definitely as representing that species by Hebard in 1936.

This insect occurs in central western Oregon from Mount Tabor and Forest Grove south to Eugene and Alsea Mountain. It may also extend into adjacent Washington but southward in Oregon is supplanted by the races of *ascensus*.

**Melanoplus ascensus ascensus** Scudder (Pl. X, fig. 2.)

1899. *Melanoplus ascensus* Scudder (in part), Proc. Davenport Acad. Nat. Sci., VII, p. 196, pl. 9, fig. 3. [♂, ♀; Mount Shasta, California.[3]]

1930. *Melanoplus validus pinicola* Fulton, Ann. Ent. Soc. Amer., XXIII, p. 622, fig. 1m. [♂, ♀; [west side of] Klamath Lake (type locality), Upper Klamath Marsh and Anna, Oregon.]

From study of paratypes of *ascensus* and *validus pinicola* in my collection it is evident that the latter is a synonym. Had Fulton Californian material, the name would probably not have been proposed. The differences shown are certainly insufficient to warrant nominal recognition in a species subject to such an unusual amount of both individual and local variation. The color of the caudal tibiae may have been given some weight, but this is clearly shown by series now available to have no racial value.

All of both sexes from the Sierras (except a male from Crater Lake) and the Warner Mountains have the caudal tibiae deep glaucous, but those from the lowlands to the east of the former, a single male from Crater Lake and those from northwestern California have the caudal tibiae coral red. From examination of all the material of this species it is clear that the color of the caudal tibiae has no value in distinguishing any of its races. The same is true of the caudal femora, which in some series are usually very strikingly marked with three pale areas on the external face, but in other series are almost immaculate, particularly in the females.

From *saltator* all of the races of *ascensus* may be separated by the weaker and less sudden convexity distad on each side of the male supra-anal plate. In *ascensus ascensus* the enlarged distal portion of the male cerci appears less triangular than in the other races, the dorso-proximal portion and apex being less sharply rounded. The dorsal lobes of the penis in the delicate apical produced portion normally lie between the sharp erect apices of the ectoparameres and curve about them forming a cephalic and caudal lobation of equal size. Each series shows some variation in one or both of these features and, were the species not evidently so plastic, racial separation might in several cases have appeared advisable.

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[3] The male from Portland, Oregon, represents *saltator*. It is identical with the type of *saltator*, described and figured from that locality by Scudder in 1897.

**Melanoplus ascensus validus** Scudder (Pl. X, fig. 3.)

1899. *Melanoplus validus* Scudder, (in part), Proc. Davenport Acad. Nat. Sci., VII, p. 197. [♂, ♀; Grants Pass (type locality) and Glendale (atypic), Oregon.[4]]

1899. *Melanoplus debilis* Scudder, Proc. Davenport Acad. Nat. Sci., VII, p. 201. [♂, ♀; Ashland (type locality) and Siskiyou (atypic), Oregon.]

Study of the paratypes of *ascensus, validus* and *debilis* in the author's collection and the series now at hand shows beyond question not only that *validus* can not be given higher than racial status but that *debilis* is a synonym. Scudder separated the latter mainly on size, color and the absence of minute furcula. The first two features have no diagnostic significance and very minute furcula are present in the paratypic male of *debilis* before me.

In *ascensus validus* the caudal tibiae are often glaucous (rich or weak) or pink (to coral red) in the same sex in the same series. The caudal femora vary in intensity of color pattern to the same degree as in *ascensus ascensus*.

The following material is before me.

OREGON: Glendale, 15♂, 9♀, 1 juv. ♀ (slightly atypical toward *ascensus ascensus*). Grants Pass, 1♂. Medford, 1♂. Ashland, 2♂, 1♀. Siskiyou, 32♂, 24♀, (slightly atypical toward *ascensus ascensus*).

The Glendale series shows divergence toward *ascensus ascensus* only in the form of the male cerci while such is true for the Siskiyou series only in the form of the penis.

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[4] Scudder also originally included material of *saltator* from Portland, Corvallis and Philomath and of the subsequently described *ascensus calapooyae* from Divide, Drain and Roseburg.

It is evident that the individual variability in this insect is great and as it is as yet known typical from only five localities in a small area in central southwestern Oregon its racial validity may yet not be considered unequivocally established.

**Melanoplus ascensus calapooyae** Hebard (Pl. X, fig. 4.)

1920. *Melanoplus calapooyae* Hebard, Trans Amer. Ent. Soc., XLVI, p. 385, pl. 17, fig. 8 and pl. 18, fig. 8. [♂, ♀; Divide (type locality) and Drain, Oregon.]

Fulton reduced *calapooyae* to racial status in 1930, but placed it as a race of *validus*. In 1899 Scudder incorrectly recorded material of this race from Divide, Drain and Roseburg in the series described as *validus*, while in 1930 Fulton also recorded males from Roseburg and Canyonville as *validus*.

The present race is distinguished by the very much larger distal triangular expansion of the male cerci. The penis also has the cochleation of the dorsal lobes more ample and these are rotated caudad so that their concave surfaces surround the vertical acute apices of the ectoparameres from behind instead of from between them, thus giving a very different appearance. Close agreement in this feature alone is shown by two of the three males from Crabtree, Oregon, here discussed under *saltator*.

OREGON: Cresswell, 1♂. Cottage Grove, 2♂. Divide, 99♂, 76♀, 1 juv. ♀. Drain, 6♂, 2♀. Roseburg, 1♂, 1♀. Woodruff Meadows, 8♂, 2♀, (slightly atypical, the male cerci less triangular distad and thus showing definite divergence toward *ascensus ascensus*).

The caudal tibiae of the males are buffy, sometimes with a weak glaucous or pink tinge, of the females rich pink, but in the atypic Woodruff Meadow series they are coral red in both sexes. Though marked as in the other races, the caudal femora externally usually show only moderate color contrasts with the paler areas extensive and confluent.

This race evidently occupies the area between the southern limits of *saltator* and the northern limits of *ascensus validus*, the series from Woodruff Meadows to the east atypic toward *ascensus ascensus*.

The following material is before me.

OREGON: Scott, 16♂, 47♀. Dry Butte, 3♂, 3♀. Fort Klamath, 5♀. Upper Klamath Marsh, 1♂, 1♀. West side of Klamath Lake, 1♂ (slightly atypic toward *ascensus validus*). Walker Mountain, 3♂, 7♀. Cedar Peak in Warner Mountains, 2♂, 1♀.

CALIFORNIA: Mount Shasta, 2♂, 1♀. Harkness Peak, 6♂, 10♀. Juniper Lake, 1♂. Westwood, 2♂.

Beside these specimens other material, undoubtedly representing *ascensus*, but if referable to the present race atypic in having the dorsal lobes of the penis more slender (much as in *saltator*), is before me.

WASHINGTON: Soda Springs in Yakima County, 1♂ (caudal tibiae pink).

OREGON: Lower northern slopes of Mount Hood, 3♂, 1♀, (caudal tibiae pink).

CALIFORNIA: Mount Shasta, 3♂, 5♀, (caudal tibiae glaucous, rarely pinkish buff in males from this locality).

The following specimens are also atypic, the dorsal lobes of the penis rotated as normal in *ascensus calapooyae.* They have the caudal tibiae pink.

WASHINGTON: Satus Pass, 2♂. Cliffdell, 1♂.

OREGON: Crater Lake, 1♂.

In extreme southwestern Oregon and northwestern California intergradation with *ascensus validus* is shown by the following series.

OREGON: Kerby, 7♂, 1♀ (caudal tibiae glaucous in 6♂, pink in 1♂, 1♀). Holland, 1♂ (caudal tibiae glaucous).

CALIFORNIA: Medione Camp ten miles east of Gassquet in Del Norte County, 19♂, 7♀ (caudal tibiae pink), 1 juv. ♀.

Typically this race is known from Mount Shasta south through the Sierra Nevada of California to Harkness Peak and Westwood, and in Oregon from Cedar Peak in the Warner Mountains and along the eastern base of the Cascade Mountains in the lowlands as far north as Scott. Intergradation with *ascensus validus* occurs in northwestern California and extreme southwestern Oregon and with *ascensus calapooyae* in the eastern portion of the Calapooya Mountains near where they join the Cascades. Atypical material of *ascensus ascensus* is recorded above from the Cascade Mountains from Crater Lake, Oregon, north to Soda Springs, Washington.

## PART XI. THE FEMUR-NIGRUM GROUP OF THE GENUS MELANOPLUS (Supplement)

I revised this group in 1935, establishing the synonymy and giving the known distribution of the species. A distinct new species, *pinaleno*, is here described which shows close relationship to *magdalenae* Hebard.

The following key is given merely as a guide to distinguish the males of the species, (there numbered according to their proper sequence), for the variation occurring in many of the characters which distinguish them prevents the proper presentation of such characters in anything but a detailed discussion.

1. Cercus variously widened distad. Caudal margin of pronotum weakly to distinctly rounded obtuse-angulate produced. ....................2

   Cercus narrowing to apex. Caudal margin of pronotum nearly to definitely truncate. ..............................................5

2. Cercus with distal portion expanded into a rounded, regular, spatulation which is vertical and not bent inward. ..........................3

   Cercus with distal portion less regularly expanded and bent inward distad. (Subgenital plate normal, very bluntly and broadly binodose at apex, these nodes sometimes fusing. Caudal tibiae glaucous in males, glaucous or pink in females.) ............................4

3. Cercus broad and short, its large distal spatulate portion subquadrate with distal margin truncate. Penis distinctive. Subgenital plate weakly produced in a blunt tubercle at apex. Caudal tibiae pink in both sexes. White and Sacramento Mountains, New Mexico.
   1. *calidus* Scudder

   Cercus slender and elongate, its much smaller distal spatulate portion well rounded. Penis distinctive but more of the type of that of the following members of the group in having the apical projections elongate and intricately developed. Subgenital plate quite strongly produced in a blunt tubercle at apex. Caudal tibiae glaucous in both sexes. Chiricahua Mountains, Arizona. .......2. *chiricahuae* Hebard

4. Supra-anal plate more simple, narrower with lateral margins not showing concavity meso-distad. Cercus with irregular distal portion quite sharply inbent, that lamellation narrowing slightly to its moderately oblique distal margin. Arizona plateau and mountains from south rim of Grand Canyon south to Dewey and the vicinity of Prescott.
   3. *femur-nigrum* Scudder

   Supra-anal plate more specialized, broader with lateral margins concave meso-distad. Cercus with more irregular distal portion less strongly inbent, the lamellate distal portion elongate and appearing faintly trilobate. Magdalena Mountains, New Mexico; White Mountains and adjacent plateau, Arizona. ..................4. *snowii* Scudder

5. Less robust. Furcula shorter. Cercus tapering more conspicuously in distal portion. Subgenital plate terminated in a prominent apical tubercle........................................................6

More robust. Furcula longer, (represented by small tapering spikes.) Cercus very definitely less than twice as long as broad, not tapering distad and so with apex much broader and much more broadly rounded. Penis highly specialized. Subgenital plate at apex feebly and bluntly tuberculate or bituberculate. (Caudal femora (as in *magdalenae* normal for group) with external pagina usually dark (particularly in males) with a very conspicuous pale ventral marginal band.) Caudal tibiae normally rich pink; buffy in one male and frequently suffused with brown on the sides proximad and distad in that sex, buffy with a very faint glaucous tinge in rare females. White Mountains, San Francisco Mountains and Bill Williams Mountain, Arizona.
7. *truncatus* Scudder[5]

6. Intermediate in degree of robustness between *truncatus* and *pinaleno*. Furcula represented by small tapering spikes, shorter than those of *truncatus*, longer than those of *pinaleno*. Cercus narrower than in *truncatus*, somewhat broader than in *pinaleno*, slightly to distinctly less than twice as long as the greatest (proximal) width. Penis broader and not as highly specialized as in *truncatus*, of same character as in *pinaleno* but broader. Caudal femora normal for group, with external pagina usually dark (particularly in males) with a very conspicuous pale ventral marginal band. Caudal tibiae deep pink. Magdalena Mountains,[6] New Mexico..........5. *magdalenae* Hebard

Only moderately robust for group. Furcula very small, short, no longer than broad. Cercus narrowest, fully twice as long as greatest (proximal) width Penis of same general type but not as broad Caudal femora distinctive, in males rich deep red ventrad and ventro-externally, entirely lacking a pale ventral marginal band on external pagina. Caudal tibiae glaucous. Mount Graham in Pinaleno Mountains, Arizona. ..............................6. *pinaleno* new species

**Melanoplus pinaleno** new species (Pl. X, figs. 5 to 7.)

As may be found from the accompanying key, the present species is nearest *magdalenae* Hebard.[7] It is likely that these insects occur only at high elevations and are isolated and fixed in features which in a great many forms of Orthoptera are subject to much plasticity. Similar in many features, other characters show them to be definitely distinct.

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[5] This species in the more boreal areas (normally at higher elevations) takes the place of *femur-nigrum* in the San Francisco Mountains and probably of *snowii* in similar manner in the White Mountains of Arizona.

[6] This species takes the place of *snowii* in the more boreal areas (normally at higher elevations) in these mountains.

[7] Described Trans. Amer. Ent. Soc., LX, p. 371, pl. 25, figs. 2 to 5, (1935).

*Type.*—♂; Ridge northwest of Helicopter Peak, Mount Graham, Pinaleno Mountains, Arizona. Elevation 9700 feet. August 21, 1934. (E. D. Ball). [Hebard Collection, Type no. 1309].

Size slightly below medium, form normal for the group. Vertex and frontal costa as in *magdalenae*. Pronotum with medio-longitudinal carina almost obsolete on prozona, fine and percurrent on metazona, caudal margin of dorsum showing very faint convexity. Prosternal spine comparatively short, shorter even than in *magdalenae*, its apex moderately transverse and bluntly rounded. Elongate ovate tegminal pads considerably shorter than pronotum, separated by a very considerable interval. Apex of abdomen moderately enlarged. Furcula represented by very small blunt triangular projections, no longer than basal width. Supra-anal plate triangular, basal width equal to length, lateral margins very feebly convex, convergent, medio-longitudinal sulcus deep in proximal two-fifths and moderately deep distad, lateral portions with surface moderately concave. Cercus of same general type as in *magdalenae* but more slender, fully twice as long as proximal width, external surface moderately swollen except the flattened tip, lateral margins very faintly convergent in proximal three-fifths, thence more strongly convergent in apical portion which is directed dorso-caudad with apex broadly rounded. Penis a moderately broad erect shaft, with margins meeting ventro-caudad to form a narrow V-emargination; proximal processes large, delicately cochleate, distad curving inward so that their acute apices are attingent; succeeding processes very slender, erect, almost concealed along inner margins of proximal processes and not as much produced. Subgenital plate convex with a very prominent blunt apical tubercle.

*Allotype.*—♀; same data as type. [Hebard Collection].

Larger and more robust than male. Pronotum with medio-longitudinal carina very faintly indicated on prozona, fine but distinct on metazona. Prosternal spine much as in male but with apex less transverse. Tegminal pads similar to those of male but even more widely separated. Ovipositor valves moderately elongate, much as in this sex of *chiricahuae*.

*Measurements.*—The measurements of a paratypic male, bearing the same data (a moderately large immature male is also before me), follow those of the type. Length of body ♂ (prior to extrusion of penis) 17. and 17., ♀ 18.2; length of pronotum ♂ 4. and 3.9, ♀ 4.4; caudal width of pronotal disk ♂ 2.7 and 2.8, ♀ 3.7; length of tegmen ♂ 3.5 (estimated, damaged) and 2.9 (2.6 on other side), ♀ 3.7; greatest width of tegmen ♂ 1.6 and 1.8, ♀ 2.; length of caudal femur ♂ 9.7 and 9.5, ♀ 10.9 mm.

*Coloration.*—General coloration of male brown, postocular bar broad, broadening very extensively on the pronotal lateral lobes and leaving only a narrow ventral portion paler, but terminating just caudad of the principal sulcus (thus quite different than the normal for the brachypterous members of the genus except those of the Immunis Group). Face, genae, cephalic and median limbs brownish buff. Caudal femora dorsad brownish buff with three slightly darker suffusions, external surface dark brown changing to a garnet brown ventrad, ventral surface brilliant deep nopal red, internal surface dull reddish, genicular areas dark brown. Caudal tibiae glaucous, paler at bases.

Female much paler and more uniformly colored, dull yellowish brown, caudal femora faintly tinged with reddish ventrad. Caudal tibiae light glaucous, paler at bases. Postocular bar and dark areas of caudal femora subobsolete.

The immature male, unlike the adults, has the caudal tibiae buff, the caudal femora with a line dorso-proximad and the dorsal half of the external pagina black. The other portions are buffy brown, the abdomen dull purplish brown dorsad.

## PART XII. THE INDIGENS GROUP OF THE GENUS MELANOPLUS (Supplement)

When studying this Group in 1936 I found that I had determined and returned, without examination of the male penis, a pair from Taft, Montana. As I had a large series of *indigens digitifer* which I was then describing,[8] from as close as Haugan, Montana, I felt justified in so recording that pair but wrote for them to verify my decision. The entire series from Taft is now before me, sent through the kindness of the collector E. R. Buckell, and proves to my surprise to represent an undescribed race of the related species *payettei* Hebard. This species is distinguished from the others of the Group by the very distinctive penis and the less produced apex of the male subgenital plate.

**Melanoplus payettei picropidzae** new subspecies

(Pl. X, figs. 8 to 10; pl. XI, figs. 11, 12.)

This geographic race may be separated from *payettei payettei*, known from the mountains of central western Idaho and adjacent Washington, by the proportionately larger and less divergent furcula, proportionately larger cerci which distad are broader with apex truncate and narrower penis. Females of the species of the Indigens Group possess no striking differences.

The race may be limited in eastward distribution by the area of the Bitter Root Mountains on the western boundary of Montana. It may be the condition present in the mountains of central northern and central Idaho, regions from which very little is yet known as to the distribution of the brachypterous Melanopli.

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[8] Trans. Amer. Ent. Soc., LXII, p. 178, pl. 12, fig. 9, pl. 13, figs. 4 and 5.

*Type.* — ♂ ; Taft, eastern slopes below Saint Regis Pass between the Coeur d'Alene and Bitter Root Mountains, Montana. July 15, 1929. (E. R. Buckell). [Hebard Collection, Type no. 1318].

Indistinguishable from the other nearest species and races of the Indigens Group except as noted above, the coloration of the caudal femora may possibly also prove an aid though probably subject to decided local variation. Size and form medium. Vertex and frontal costa as in *indigens missoulae* Hebard,[9] the former moderately broad with distinct lateral carinae, its surface impressed weakly (to quite strongly in paratype) at median ocellus. Pronotum with a fine medio-longitudinal carina on metazona, which is absent on prozona. Prosternal spine moderately elongate, rather slender, with apex well rounded. Tegmen ovate, separated by a brief interval, length considerably less than that of pronotum. Apex of abdomen moderately enlarged. Furcula represented by a pair of fairly thick, tapering and moderately divergent projections which are proportionately larger than in typical *payettei*, each over twice as long as width just beyond the thickened areas from which they spring. Supra-anal plate shield-shaped, lateral margins decidedly thickened and elevated in proximal third, dorsal surface longitudinally broadly concave laterad with median sulcus strongly defined only proximad. Cercus with length slightly over twice proximal width, curvature dorso-caudad almost obsolete; lateral margins faintly convergent in proximal third, very faintly divergent in median third and in distal third parallel, then rounding broadly into the transverse, truncate distal margin; external surface feebly and irregularly impressed submarginally distad. Penis as in *payettei payettei* with dorsal lobes developed into two large erect transverse adjacent fleshy plates which curve moderately cephalad distad, which plates are however narrower than in that race, the acute apices of the ectoparameres visible meso-proximad at their caudal bases. Apex of subgenital plate as in *payettei payettei,* slightly but appreciably blunter than in the related species.

*Allotype.*— ♀ ; same data as type. [Hebard Collection].

Very similar to male but larger and more robust. Vertex broader with impression weaker. Tegmina as widely separated (varying to slightly more widely separated in paratypes and in them slightly shorter to distinctly more elongate). Prosternal spine shorter, broader (and in some paratypes decidedly heavier). Ovipositor valves of medium length and moderately curved distad; dorsal surface of dorsal valves weakly nodose proximad, the lateral margins acute, the external subcrenulate but very feebly and bluntly toothed proximad.

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[9] Described, Trans. Amer. Ent. Soc., LXII, p. 175, pl. 12, fig. 6, pl. 13, figs. 1 and 2, (1936).

*Measurements.*—The extremes are: length of body ♂ (before extrusion of penis) 17.5 and 18., ♀ 21.7 to 26.2; length of pronotum ♂ 4.3 and 4.7, ♀ 4.8 to 5.2; caudal width of pronotal disk ♂ 2.6 and 2.7, ♀ 3.7 to 3.9; length of tegmen ♂ 3. and 3.8, ♀ 4.2 to 4.8; length of caudal femur ♂ 9.7 and 10.2, ♀ 11.5 to 12. mm.

*Coloration.*—Generally dark brown, the paler brown recessive specimens with color pattern weaker. A broad dark postocular bar extends to the principal sulcus of the pronotal lateral lobes and is continued, though weaker, to the caudal margin in all but the palest specimens. Face, ventral portion of pronotal lateral lobes, cephalic and median limbs brownish buff; ventral surface buff, but male subgenital plate dark brown except meso-proximad. Dorsum different shades of brown, with that portion of abdomen buffy in males. Caudal femora with brown markings very weak and suffused, the ventro-external and ventro-internal portions bright salmon orange varying to tinged with scarlet, the intervening ventral and the inner surfaces yellowish. Caudal tibiae glaucous (but buffy in one female) suffused with brown laterad.

From knowledge of the allied species and races I believe it probable that additional series of this race will also show variation in the furcula, supra-anal plate and possibly the cerci of the males. It is this individual and environmental variation coupled with the close general similarity of the species and the abundance of races which makes the Indigens Group one of the most difficult. This is aggravated by the fact that material is yet to be secured in many large areas where the Group is unquestionably present.

A male and four female paratypes bear the same data as the type. This series was found on the slope of a dry ravine among rank grasses and low plants. In the vicinity were a few clumps of Douglas Fir and choke-cherry.

## PART XIII. THE MANCUS GROUP OF THE GENUS MELANOPLUS

The species of this group are of unusual interest. All closely resemble each other in general appearance and structure. The male cerci afford much the most valuable features of external difference, but the characters of the penis are found to be much more important in determining the species and their proper relationships. This latter situation is quite different from that which is shown by the species and races of the evidently more plastic Saltator Group here discussed in Part X.

All of the five species invariably have pink caudal tibiae in both sexes. All are sylvan or are present in the open where usually characteristically sylvan ground cover occurs, such as huckleberry bushes, Sweet Fern, Sheep Laurel and forest grasses. All are found in the Appalachian Mountains, *mancus* being further widely locally distributed in New England and southeastern Canada, *islandicus* in the central portion of the northern United States and southern Canada and *celatus* in the adjacent plateaus and mountains of Tennessee (and probably Kentucky).

Females are indistinguishable or separable only on subtile characters or average slight differences which could be treated only at considerable length and might even then be misleading. The following key is therefore furnished to distinguish only males.

1. Cercus with ventral margin (rounded rect- to obtuse) angulate produced mesad. Penis distinctive (with shaft short and thick, the intricately specialized projections large). .................... 5. *divergens* Morse
   Cercus with ventral margin not produced mesad.................... 2
2. Cercus with apex faintly to definitely spatulate. Penis with shaft short and thick. .................................................... 3
   Cercus not enlarged distad. Penis with shaft more elongate and more slender.................................................... 4
3. Penis with shaft short and thick, simple; the intricately specialized projections small. Cercus moderately elongate and moderately broad with apex faintly to definitely spatulate).......... 1. *mancus* (Smith)
   Penis with shaft short and very thick with distal portions cephalad produced in two adjacent cochleate lobes the margins of which are very finely and evenly serrulate. Cercus rather short and stout with apex definitely spatulate. .................. 4. *serrulatus* new species
4. Penis with shaft very elongate and very slender, the sheath extending equally far distad on all sides, the intricately specialized distal projections smaller. Cercus normally moderately elongate and narrow at apex, varying to (rarely) rather short and (rarely in West, much more frequently in parts of East) with apex conspicuously broader. 2. *islandicus* Blatchley
   Penis with shaft not as elongate and heavier, the sheath leaving much more of the ectoparameres exposed in caudal aspect, the intricately specialized distal projections larger. Cercus normally elongate and very narrow at apex, varying to shorter and with apex conspicuously broader. ...................................... 3. *celatus* Morse

Sufficient individual variation occurs in the cerci to lead to possible incorrect determinations or the supposition that a distinct race or even species might be represented by certain individuals. This is true for all the species of which I have large series but particularly so for *islandicus* and *celatus*, in both of which species incipient racial differentiation is strongly suggested. The species of the Mancus Group are, therefore, much more conclusively distinguished by the characters shown by the penis, which are much more constant.

**Melanoplus mancus** (Smith) (Pl. XI, figs. 1 and 2.)

1868. *Pezotettix mancus* Smith, Proc. Portland Soc. Nat. Hist., I, p. 149. [♂, ♀; Speckled Mountain, near Stoneham, Maine.]

1920. *Melanoplus mancus* Morse, Orth. of New England, p. 518, pl. 22, figs. 28 to 31, pl. 23, figs. 9 and 10.

This boreal species is probably widespread in southeastern Canada, but is as yet known there only from the series here recorded. It is widespread in favorable environment in the northern portion of the eastern United States and reaches south in the Appalachian Mountains as far as central Virginia.

The species shows little variation. Only the apices of the male cerci vary individually from feebly elongate spatulate to scarcely at all spatulate, the margins there frequently slightly irregular in curvature and the external surface sometimes weakly dimpled. The large series now available prove to my satisfaction that not even incipient racial differentiation is indicated anywhere in the range of *mancus*.

The related *islandicus* Blatchley was placed as a western race of *mancus* by me in 1932, such being strongly suggested by all external characters but now known to have been a false conclusion, as the form of the penis in *islandicus* is constant and widely distinct. The new species, *serrulatus*, from the mountains of western North Carolina, might just as easily have been confused with *mancus* had the even more distinctive development of the penis not been observed.

The following material is before me:

QUEBEC: Lac Sainte Marie, IX, 5, 1935, (F. A. Urquhart), 6♂, 2♀, [Can. Nat. and Hebard Clns.].

MAINE: Mount Sargent, 1♂, 1♀; Upper and Lower Hadlock Ponds, all on Mount Desert Island, VIII, 29, 1912, (M. Hebard; in undergrowth of mixed forest), 2♂, 1♀. Mount Megunticook, VII, 29, 1928, (M. Hebard; at summit in grassy glade of low spruce forest), 7♂, 2♀. Cape Elizabeth, VIII, 1933, (M. Hebard; in huckleberry bushes in low mixed forest near coast), 1♀.

MASSACHUSETTS: Marion, IX, 1, 1905, (M. Hebard; in undergrowth of sandy pine woods), 1♀. Heath, VIII, 6, 1932, (M. Hebard; in moss and forest grasses on hilltop at edge of deciduous forest), 3♂, 2♀, 1 juv. ♀.

CONNECTICUT: North Madison, 2♂. Woodbridge, 1♂, 1♀, [A.N.S.P.].

NEW YORK: Danby Hill, 4♂, 11♀. Ithaca, 1♂, 2♀.

NEW JERSEY: Newfoundland, 1♀.

PENNSYLVANIA: North Mountain, IX, 22, 1935, (H. R. Roberts), 2♂, 7♀. Leonardsville, 1800 feet, VII, 7, 1935, (Rehn and Rehn; in huckleberry, Sweet Fern and Sheep Laurel), 1 juv. ♂, 1 juv. ♀, [A.N.S.P.]. Skytop, 2075 feet, VII, 19, 1936, (Rehn and Rehn; few in Sweet Fern in oak scrub), 1♂, 3♀. [A.N.S.P.]. Moosic Lake, VIII, 19, 1924, 3♂. Williamsport, VIII, 10 and 11, 1924, 1♂, 1♀. Poplar Gap in Monroe County, 1850 feet, VII, 19, 1936, (Rehn and Rehn; in huckleberry and Sweet Fern), 2♂, 3♀, [A.N.S.P.]. Trout Creek in Monroe County, 1740 feet, VII, 7, 1935, (Rehn and Rehn; juvs. very abundant, adults few in second growth deciduous forest), 2♂, 5 juv. ♂, 6 juv. ♀, [A.N.S.P.]. Scotron in Monroe County, VIII, 17, 1906, (B. Long), 1♀, [A.N.S.P.]. Buffalo Flat in Union County, 2600 feet, VII, 31, 1935, (Rehn and Rehn; common in huckleberry ground cover in open and second growth mixed forest), 68♂, 78♀, 3 juv. ♀, [A.N.S.P.]. Buena Vista Springs, VIII, 27, 1916, (M. Hebard), 3♂. Still Run in Warren County, VIII, 19, 1936, (E. S. Thomas), 1♂, 1♀.

VIRGINIA: Flag Rock Pass near Warm Springs, VII, 10 and 21, 1916, (M. Hebard, 2♂. Hot Springs, VII, 3 to 20, 1916, (M. Hebard), 14♂, 12♀, 4 juv. ♀. Dunns Gap in Bath Co., VIII, 20, 1916, (M. Hebard), 1♀. Little Mountain near Hot Springs, VIII, 6, 1916, (M. Hebard), 5♂, 2♀. Deer Lick Mountain near Hot Springs, VII, 10, 1916, (M. Hebard), 6♂, 3♀. Collision Ridge in Bath County, 3200 feet, VII, 5 to VIII, 23, 1916, (M. Hebard), 35♂, 36♀. Bald Knob in Bath County, 3900 feet, VII, 28 to VIII, 14, 1916, (M. Hebard; generally abundant on summit bald in thick ground cover of greatly stunted trees and mountain plants), 50♂,[10] 53♀, 2 juv. ♀. Ridge north of Covington, 1500 feet, VIII, 16, 1916, (M. Hebard), 2♂, 2♀. (Generally distributed but in localized colonies in both deciduous and mixed forest undergrowth throughout this mountainous region.)

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[10] One of these males, though adult, has the genitalia as in the instar preceding maturity. We have previously seen this condition only in a very few males of the Melanopli from the Rocky Mountains. It may be an abnormality produced by the speeding up of period of growth in rigorous areas where the active life of the individual is comparatively short.

This species is known as far west as Ithaca, New York; Williamsport, Buffalo Gap and Buena Vista Springs, Pennsylvania, and Collison Ridge, Virginia,[11] while the southernmost locality is a ridge near Covington in the latter State. South of New England it probably occurs only at some elevation in the mountains.

**Melanoplus islandicus** Blatchley (Pl. XI, figs. 3 and 4.)

1898. *Melanoplus islandicus* Blatchley, Psyche, VIII, p. 196. [♂, ♀; La Salle Island in Les Cheneaux Islands, Michigan.]

1920. *Melanoplus islandicus* Blatchley, Orth. of Northeastern Amer., p. 388, figs. 135 d and e (outline of cercus greatly foreshortened and misleading).

E. M. Walker described *M. abortivus* from DeGrassi Point, Ontario, in 1898, which name he placed as a synonym of *islandicus* in 1899.

In 1920 Blatchley incorrectly considered *sylvestris* Morse a race of *islandicus*, while in 1932 Hebard incorrectly considered *islandicus* a race of *mancus* (Smith). Both of these errors occurred because the vital differences of the penis were unknown.

This species is sylvan, terrestrial and very local in distribution. Its nearest relative, from study of the characters of the penis, can now definitely be said to be *celatus* Morse, but in spite of the fact that both show variation, even in the large series now before me no suggestion of intergradation is anywhere indicated.

In *islandicus* the shaft of the penis is much longer and more slender than in any other species of the group. The male cercus is never enlarged distad and is there normally moderately narrow and quite sharply rounded. Slightly wider cercal apices than usual may appear in any series, but in the hilly country of the central and southern portions of eastern Ohio the cercal apices average still wider while the males from Monterey, Virginia though variable in this respect show it even more decidedly. Unusually short and broad are the cerci in the single male from Sounding Knob, Virginia. These differences I believe indicate no more than incipient racial differentiation in the southeastern portion of the distribution of *islandicus,* for in all series appreciable individual variation is shown and the broadest cercal apices in the series from Pequaming, Michigan, are as wide as the narrowest cercal apices in the series from Monterey, Virginia. Moreover, in the related *celatus,* even greater cercal variation, with no indication whatever of convergence between these species, is found.

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[11] McNeill's 1891 record from Illinois has been published as incorrect, properly referable to *Melanoplus rusticus obovatipennis*.

The following material is before me:

PENNSYLVANIA: Mechanicsville in Clarion County, VIII, 29, 1935, (Rehn and Rehn; in openings of mixed forest), 5♂, 3♀, [A.N.S.P.]. Chestnut Ridge in Westmoreland County, (O. Brugger), 1♂, 1♀, [A.N.S.P.].

MARYLAND: Jennings in Garrett County, VIII, 1911, (W. Stone), 2♀, [A.N.S.P.].

VIRGINIA: Sounding Knob, 4200 to 4300 feet, VIII, 21, 1916, (M. Hebard; scarce in undergrowth at edge of forest), 1♂ (cerci very short and very broad at apices), 2♀. Monterey, VIII to IX, 1914, (H. Fox), 9♂ (cerci moderately broad to broad at apices), 11♀,[12] [Hebard Cln. and U.S.N.M.].

ONTARIO: DeGrassi Point, 2♂, 2♀, *paratypes* of *abortivus,* [A.N.S.P. and Hebard Clns.]. Gilford, 1♂, 1♀.

OHIO:[13] Perry, VIII, 12, 1931, 11♂, 5♀. Thompson, 1♂, 1♀. Stebbins Gulch, VIII, 14, 1931, 3♂, 1♀. Black Hand, VIII, 21, 1931, 4♂ (2 normal, 2 with cerci broader than usual at apices), 2♀. Licking Township, VIII, 19, 1931, 5♂ (cerci slightly to markedly broader than usual at apices), 2♀. Philo, VIII, 27, 1933, 1♀. Deerfield Township in Morgan County, 1♀. Berne Township in Fairfield County, X, 29, 1933, 2♂ (1 almost normal, 1 with cerci broader than usual at apices). Clear Creek in Good Hope Township in Hocking County, VII, 24 to VIII, 4, 1932 and 1933, 9♂ (cerci individually varying from normal to markedly broader than usual at apices), 7♀.

INDIANA: Clear Lake in Steuben County, 1♂, 1♀.

MICHIGAN: La Salle Island, 3♂, 3♀, *paratypes,* [Hebard Cln. and A.N.S.P.]. Falls of the Slate River in Baraga County, VII, 23, 1921, (M. Hebard), 2♂. Pequaming, 43♂, 45♀, 2 juv. ♂, 2 juv. ♀. Hughitt-Rawson Reserve in Gogebic County, 1♂, [A.N.S.P.].

WISCONSIN: Upper Brule River in Douglas County, 1♀, [A.N.S.P.]. Pembina, VIII, 1, 1910, (J. G. Sanders), 1♂.

MANITOBA: Whitemouth River on Dawson Road, VII, 13, 1925, (N. Criddle), 1♂.

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[12] This series was recorded as *Melanoplus celatus* by Hebard in Fox in 1917.

[13] All of this material was secured by E. S. Thomas and C. F. Walker for the Ohio State Museum. A series of the duplicates is now in the author's collection.

MINNESOTA: Kawishiwi River, 2♂. Poplar Lake in Cook County, 1♂. Two Harbors, 1♂. Cook County, VII, 30, 1936, (C. E. Mickel), 1♂, 2♀, [Univ. of Minn.]. Ely, IX, 7, 1935, (R. H. Daggy), 1♀, [Univ. of Minn.]. Friesland, 1♀. Sunrise, 1♂. St. Croix Springs, 1♂, 1♀. Pine River in Cass County, VIII, 13, 1935, (A. B. Gurney), 1♀, [Univ. of Minn.].

Eastern known limits for *islandicus* are North River and Island Lake in Algonquin Park and Tornoto, Ontario; Mechanicsville in Clarion County and Chestnut Ridge in Westmoreland County, Pennsylvania; Jennings, Maryland, and Sounding Knob, Virginia. Northern limits are Mechanicsville, Pennsylvania; North River and Island Lake in Algonquin Park, Lake Kabinakagami in Algoma and Fort William, Ontario, and the Whitemouth River on Dawson Road, Manitoba. Western limits are the latter, Big Falls in Koochiching County and Pine River in Cass County, Minnesota. Southern limits the latter and Sunrise, Minnesota;[14] Pembine, Wisconsin; Clear Lake in Steuben County, Indiana; Clear Creek in Hocking County and Deerfield Township in Morgan County, Ohio, and Sounding Knob, Virginia.

**Melanoplus celatus** Morse (Pl. XI, fig. 5.)

1904. *Melanoplus celatus* Morse, Psyche, xi, p. 10. [♂; Wytheville, Virginia, at 3000 to 4000 feet.]

1904. *Melanoplus sylvestris* Morse, Psyche, xi, p. 10. [♂, ♀; Blowing Rock (type locality), Linville, Lovering's and Pineola, North Carolina; all at 3500 to 4000 feet.]

Comparison of paratypes in the author's collection prove beyond doubt the synonymy indicated above. The male cerci are unusually variable in this species and the differences noted by Morse for those of *sylvestris* do not have even racial significance.

The penis in this species is nearest that of *islandicus* but has the shaft shorter and thicker, the sheath (formed by the dorsal lobes) leaving much more of the ectoparameres exposed in caudal aspect, while their complex exposed distal portions are larger. No intergradation between these conditions is shown by any of the material studied.

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[14] Although I recorded this species as *mancus islandicus* in 1932 from Lansing, Hamburg and Bedford, Iowa and that name was consequently included in the Iowa list published by Knutson and Jaques in 1935, I believe that the insect has not yet been taken in Iowa. Somes so labelled material now in my collection though he did not record the species from Minnesota. I believe that he used by mistake numbers for Iowa which actually had been given for Minnesota localities. Several other equally serious mistakes are known to have been made by that author who at that time was far from well.

The following material is before me.

VIRGINIA: Wytheville, 1♂, *paratype*.

NORTH CAROLINA: Blowing Rock, 1♂, 1♀, *paratypes* of *sylvestris*. Lovering's in Burke County, 1♂, 1♀, *paratypes* of *sylvestris*.

SOUTH CAROLINA: Caesar's Head in Greenville County, VI, 29, 1926 and VIII, 23, 1933, (F. Sherman), 2♂ (apices of cerci slightly broader than typical), 1♀, [Sherman and Hebard Clns.]. Pinnacle Mountain in Pickens County, VI, 19, 1934, (F. Sherman), 1♂ (apices of cerci unusually broad, as broad as broadest developed in *islandicus*, from Sounding Knob, Virginia). Rocky Bottom in Pickens County, VI, 16 to X, 3, 1927 to 1932, (F. Sherman), 5♂ (apices of cerci varying from slightly to decidedly broader than typical), 9♀, [Sherman and Hebard Clns.]. Cashiers Valley Road in Oconee County, X, 16, 1934, (O. L. Cartwright), 1♂ (apices of cerci considerably broader than typical).

GEORGIA:[15] Pinnacle Peak in Rabun County, 1♀. Rabun County, 1♀, [A.N.S.P.]. Clayton, 2000 feet, 1♂ (apices of cerci considerably broader than typical).

TENNESSEE: Clinch Mountains in Grainger County, IX, 2, 1933, (R. Dury), 1♂, 1♀ (typical, size very large for the species), [Ohio State Mus.]. Allardt in Fentress County, 1200 feet, VIII, 16, 1922, (T. H. Hubbell), 1♂ (apices of cerci slightly broader than typical). Grassy Cove in Cumberland County, 1800 and 2000 feet, VII, 11 and 13, 1922, (T. H. Hubbell), 2♂, 2♀.

The known distribution of this insect is defined by the above localities. More material from all parts of its range is badly needed. The single series before me, from Rocky Bottom, South Carolina, shows so much individual variation in the form of the male cerci that I do not believe a geographic race of the more southern area can be recognized, though an average greater, and sometimes strikingly greater, width of the cercal apices is there present.

**Melanoplus serrulatus** new species (Pl. X, figs. 6 to 8.)

Generally similar to the other species of this group, the present species is nearest *mancus* in the form of the male cerci which, similarly spatulate, are definitely shorter and broader. The penis is, however, not only differently developed than in any other species but shows decidedly the highest specialization.

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[15] This material and a female from Black Mountain, North Carolina, was recorded as *sylvestris* by Rehn and Hebard in 1916, at which time that the possibility that it represented a race of *islandicus* was suggested.

*Type.* — ♂; Nantahala Mountains, extreme western North Carolina. Elevation 2500 feet. October 5, 1933. (C. F. Walker). [Hebard Collection, Type no. 1319].

Size medium small, form compact and fairly robust for the brachypterous Melanopli. A weak longitudinal concavity present between the eyes and frontal costa weakly concave below the median ocellus, above that point broader and deplanate, rounded into the deplanate fastigium of the vertex. Antennae medium, decidedly shorter than caudal femur. Eye prominent, vertical length intermediate between that of sub-ocular sulcus and that of cheek. Pronotum with medio-longitudinal carina present only in metazona, three transverse sulci well defined (complete in type, with first or first and second briefly obsolete mesad in paratypes); caudal margin broadly convex, its lateral portions nearly straight. Tegmina represented by small rounded moderately separated pads, their apices showing a trace of angulation, their surface evenly weakly convex and covered by a rather regular network of decided veinlets. Prosternal spine short, stout, tapering abruptly to the sharply rounded apex, approximately as long as basal width. Furcula represented by a pair of short stout parallel fingers, their swollen bases attingent. Supra-anal plate rather small and narrow triangularly shield-shaped, approximately one-third longer than broad; median sulcus very deep in proximal two-thirds, lateral portions deeply concave. Cerci short and stout, tapering moderately in proximal half, then expanding into the moderately spatulate apical portion, there with outer surface convex but dimpled at the distal margin. Subgenital plate small, blunt conical, at the transverse rounded apex very slightly produced (with surface there sometimes dimpled). Penis with base very large, its shaft short and thick, the margins flaring in cephalic meso-internal portion into bilobed projections which have their margins microscopically serrulate; from within these project a pair of small vertical transverse and before them a pair of small vertical longitudinal lamellae, just caudad of which the simple aciculate apices of the ectoparameres project not as far.

*Allotype.* — ♀; same data as type. [Hebard Collection].

Larger and more robust than male. Concavity of interocular area and frontal costa even weaker and the former more limited in extent. Tegmina faintly more separated (in allotype, but attingent in paratype). Prosternal spine similar to that of male. Ovipositor valves moderately elongate, curvature at apices extensive, not strong.

*Coloration.* — The small series before me is dark brown with caudal femora showing externally the usual (in the group) three paler areas extensive but obscured. All are darker and less red-brown than is usual in this group, in this respect showing nearest superficial similarity to the series of *divergens* Morse which I secured on Jones Peak. Different responses in these features to immediate environment is, however, to be expected. Other paler and dark markings just as in the other species of the group.

*Measurements.*—Two male and one female paratypes bearing the same data show, with the type and allotype, the following extremes in measurements: length of body ♂ 16.2 and 17.2, ♀ 22.3 and 23.3; length of pronotum ♂ 4.2 and 4.4, ♀ 5.2 and 5.3; caudal width of pronotal disk ♂ 2.8 and 3., ♀ 3.8 and 3.8; length of tegmen ♂ 2.8 and 2.9, ♀ 3.8 and 4.; length of caudal femur ♂ 9.7 and 10.3, ♀ 11.5 and 12.2 mm.

This may prove to be a species confined to the valleys and lower slopes in the mountains.

**Melanoplus divergens** Morse (Pl. XI, figs. 9 and 10.)

1904. *Melanoplus divergens* Morse, Psyche, xi, p. 8. [♂, ♀; [Jones Knob in] Balsam [Mountains], North Carolina.]

1904. *Melanoplus divergens* Morse, Carnegie Inst. of Washington, Publ. 18, p. 54, fig. 5.

I collected a series of this interesting species, distinctive in the angulate production of the ventral margin of the male cerci at 4000 feet on Jones Knob in the Balsam Mountains in a glade in the deciduous forest (just below the thickly conifer-clad summit), which was reported by Rehn and Hebard in 1910.

Specimens now before me.

North Carolina: Crestmont in Haywood County, from 1800 to 3000 feet, VII, 28 and 29, 1922, (T. H. Hubbell), 2♂, 2♀. Indian Pass in the Great Smoky Mountains, IX, 4, 1933, (R. Dury), 4♂, 2♀, [Ohio State Mus. and Hebard Cln.]. Hendersonville, VI, 21, 1924, (H. Fox), 1♀. Jones Knob in Balsam Mountains, 2♂, 2♀, *paratypes*; 3♂, 3♀, [Hebard Cln. and A.N.S.P.].

Georgia: Rabun Bald, 4600 to 4717 feet (summit), IX, 5, 1917, (Rehn and Hebard; very scarce in huckleberry bushes and grasses under low oaks and chestnut trees), 3♂, 4♀, [Hebard Cln. and A.N.S.P.]. Chestnut Ridge on Rabun Bald, IX, 5, 1917, 4000 feet, (Rehn and Hebard; few in similar environment but richer undergrowth under higher trees), 3♂, 5♀, [Hebard Cln. and A.N.S.P.].

This species is, I believe, confined to the most boreal spots in the southern Appalachian Mountains. Its distribution is, therefore, highly discontinuous.

## PART XIV. THE TEXANUS GROUP OF THE GENUS MELANOPLUS

Discovery of a new species of this Group and realization that the previously known four species have in all cases been treated separately in the literature, makes it advisable to comment on the characters which they share and publish a key when describing the fifth species, *oklahomae*, there giving a number before each to indicate the proper sequence.

All of the species are large for the brachypterous forms of *Melanoplus* and are very similar in general appearance. They are light and somewhat reddish brown with a heavy sharply defined blackish brown postocular band stopping abruptly at the principal sulcus on the lateral lobes of the pronotum, the pleura black with a striking oblique brownish buff band. The caudal femora have two weak (rarely decided) oblique dark markings on the external surface in its dorsal portion individually ranging to immaculate. The caudal margin of the pronotal disk is obtuse-angulate produced with apex rounded. The tegmina are lanceolate and slightly overlapping. The caudal tibiae are pink.

All are found only from southern Kansas to south-central eastern Texas in that area which intervenes between the definitely humid East and the typical plains. This includes western Arkansas and southeastern Missouri, in which latter area none have as yet been found but almost certainly occur. All are probably inhabitants of the open grasslands.

Females appear to be indistinguishable. Males may be separated by the following key.

1. Supra-anal plate simple. .......................................... 2
   Supra-anal plate with two large longitudinal subadjacent rectangular areas meso-proximad. (Cercus large, expansion curved inward and twisted horizontally distad in a large irregularly trilobate lamellate plate with its dorsal surface moderately concave. Exposed portion of parameres very elongate, tubular, curved cephalad but not specialized at apices.) From Ben Wheeler to Walker County, central eastern Texas. .......................................... 5. *angularis* Little
2. Cercus only moderately expanded. .......................................... 3
   Cercus very strongly expanded. .......................................... 4
3. Penis with apices of ectoparameres scarcely produced beyond the surrounding thickened dorsal margins of the dorsal lobes. Cercus mod-

erately elongate, gradually and evenly tapering to distal third, there with dorsal margins feebly divergent then rounding into the transverse distal margin, this enlarged distal portion inbent with dorsal surface (which slants dorso-laterally) feebly concave. Occupies that portion of the prairie strip between the humid East and semi-arid plains from Labette and Cowley Counties in southeastern Kansas south to Waxahatchie and Comanche County in northeastern Texas.[16] 1. *texanus* (Scudder)

Penis with exposed portion of parameres elongate, tubular, curved cephalad but not specialized at apices. Cercus comparatively small, straight, tapering in proximal third, thence expanding moderately and then narrowing, thus forming a moderately elongate spatulate distal portion which is not incurved and is rounded to its acute apex, fully twice as long as broad with external surface feebly concave. Known from Montgomery County in southeastern Kansas to Magazine Mountain, Arkansas and Bonita, Texas. .........3. *inconspicuus* Caudell[17]

4. Cercus not bent inward, produced as symmetrical lamellate plates (which curve gently into a dorso-lateral slant, with dorsal margin broadly and ventral margin more weakly convex to the rounded apex and external surface slightly convex but becoming impressed toward the margins. Penis with dorsal lobes produced to form a tubular sheath for the ectoparameres, its truncate apex simple and not surpassed by the latter which may be seen within the deep meso-caudal cleft of the tube so formed. Brazos County in south-central eastern Texas[18] (in open Post Oak woods). ................2. *warneri* Little

Cercus bent dorsad and inward in all but basal quarter, the enlarged lamellate plates then formed (which slant dorso-laterally) roughly quadrate with dorso-proximal and ventro-distal angles broadly rounded and external surface irregularly flattened. Penis with dorsal lobes produced to form a longer and more slender tubular sheath for the ectoparameres, its apex expanded and produced in points to their apices as shown in plate X, figure 13. McCurtin County and Nashoba in extreme southeastern Oklahoma.....4. *oklahomae* new species

It will be seen that the higest specialization of the supra-anal plate and cerci occurs in *angularis*, highest specialization of the penis in *oklahomae*. There are four distinctive types of penis;

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[16] Though not yet known from Oklahoma the species undoubtedly occurs in the eastern portions of that State.

[17] Morse's *latens* was placed as a synonym by Hebard in 1931, Proc. Acad. Nat. Sci., Phila., LXXXIII, p. 178.

[18] First incorrectly recorded as *texanus* from this locality by Little in 1926.

the first in *texanus*, the second in *warneri*, the third in *inconspicuus* and *angularis*, the fourth in *oklahomae*.

**Melanoplus oklahomae** new species

(Pl. X, figs. 11 to 13; pl. XI, fig. 12.)

This insect occupies a position nearest *texanus* (Scudder) and *warneri* Little, agreeing generally closely as well as in form of male furcula, supra-anal and subgenital plates. The male cercus, however, has the lamellate distal portion not at all symmetrical with dorsal section much the more produced. The penis is very different from that of either of those species, but specialization of that organ, though often of very great diagnostic value, frequently has no phylogenetic significance.

The characters which distinguish the generally very similar species of the Texanus Group are given in the preceding key.

*Type.*— ♂ ; McCurtin County, Oklahoma. June 10, 1931. [Hebard Collection, Type no. 1310].

Size large, form medium for the brachypterous species of *Melanoplus*. Fastigium normal, its surface definitely concave medio-longitudinally. Frontal costa weakly impressed at median ocellus, without lateral carinae, its surface dorsad with minute impressed punctae. Eye large, moderately prominent, nearly twice as long as the infra-ocular sulcus. Pronotum with moderate precurrent medio-longitudinal carina cut only by the principal sulcus, caudal margin of disk obtuse-angulate produced with apex rounded. Prosternal spine moderately elongate, tapering distad to the sharply rounded apex. Tegmina lanceolate, slightly longer than pronotum, slightly overlapping, tapering to the narrowly rounded apices, definition between dorsal and lateral fields feebly suggested. Genitalia as described in key, the cercus and penis of very decided diagnostic importance. Furcula very minute, well separated points. Supra-anal plate triangular, slightly broader than long, its medio-longitudinal sulcus decided in proximal half, the lateral portions broadly concave and lateral margins simple. Subgenital plate small, the apex moderately produced and bluntly rounded.

*Allotype.*— ♀ ; Nashoba, Oklahoma. June 16, 1934. (J. Stankovitch). [Hebard Collection].

Very similar to male but decidedly larger and more robust. Eye distinctly less than twice as long as infra-ocular sulcus. Prosternal spine shorter, its apex bluntly rounded. Ovipositor of medium length, distal portion of dorsal valves short and rather strongly recurved with dorsal surfaces concave, delimited proximad by a transverse ridge.

*Measurements.*—Length of body ♂ 24.3, ♀ 28.7; length of pronotum ♂ 5.8, ♀ 6.7; caudal width of pronotal disk ♂ 3.2, ♀ 4.2; length of tegmen ♂ 7.2, ♀ 8.8; length of caudal femur ♂ 12.7, ♀ 16.2 mm.

*Coloration.*—Generally light, dull reddish brown; occiput, dorsum of pronotum, tegmina dorso-proximad and in lateral portions brown (but the lighter and darker portions gradually merging and not in distinct contrast). A broad shining post-ocular blackish band terminates abruptly at the principal sulcus on the pronotal lateral lobes. Abdomen of female delicately marbled with dark brown dorso-laterad. Caudal femora with dorsal surface showing two transverse suffusions and genicular portions brown; internal surface buffy weakly tinged with orange; ventro-external surface the same in male, dull morocco-red in female. Caudal tibiae bittersweet orange (evidently recessive) in male, rich pink in female; internal spines black in distal half, external spines wholly black.

## EXPLANATION OF PLATES

### PLATE X

Fig. 1.—*Melanoplus saltator* Scudder. *Topotype.* Portland, Oregon. Lateral view of distal portion of penis. (Greatly enlarged.)

Fig. 2.—*Melanoplus ascensus ascensus* Scudder. *Paratype.* Mount Shasta, California. Lateral view of distal portion of penis. (Same scale as Fig. 1.)

Fig. 3.—*Melanoplus ascensus validus* Scudder. *Paratype.* Grants Pass, Oregon. Lateral view of distal portion of penis. (Same scale as Fig. 1.)

Fig. 4.—*Melanoplus ascensus calapooyae* Hebard. *Paratype.* Divide, Oregon. Lateral view of distal portion of penis.[19] (Same scale as Fig. 1.)

Fig. 5.—*Melanoplus pinaleno* new species. *Type.* Mount Graham, Arizona. Dorsal view of male supra-anal plate and furcula. (Much enlarged.)

Fig. 6.—*Melanoplus pinaleno* new species. *Paratype.* Mount Graham, Arizona. Lateral view of male cercus. (Much enlarged.)

Fig. 7.—*Melanoplus pinaleno* new species. *Type.* Mount Graham, Arizona. Caudal view of penis. (Greatly enlarged.)

Fig. 8.—*Melanoplus payetti picropidzae* new subspecies. *Type.* Taft, Montana. Dorsal view of male supra-anal plate and furcula. (Much enlarged.)

Fig. 9.—*Melanoplus payettei picropidzae* new subspecies. *Paratype.* Taft, Montana. Lateral view of male cercus. (Much enlarged.)

Fig. 10.—*Melanoplus payettei picropidzae* new subspecies. *Paratype.* Taft, Montana. Dorso-caudal view of penis. (Greatly enlarged.)

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[19] Due to the fact that the cochleation of the dorsal lobes of the penis is rotated caudad in *ascensus calapooyae*, the lateral external surface of one of these lobes is seen in a lateral view of the distal portion of the penis, whereas in figures 1, 2 and 3 the whole internal surface of one of these lobes is seen in the same aspect.

Fig. 11.—*Melanoplus oklahomae* new species. *Type.* McCurtin County, Oklahoma. Dorsal view of male supra-anal plate and furcula. (Much enlarged.)

Fig. 12.—*Melanoplus oklahomae* new species. *Type.* McCurtin County, Oklahoma. Lateral view of male cercus. (Much enlarged.)

Fig. 13.—*Melanoplus oklahomae* new species. *Type.* McCurtin County, Oklahoma. Caudal view of distal portions of penis. (Greatly enlarged.)

## PLATE XI

Fig. 1.—*Melanoplus mancus* (Smith). *Topotype.* Speckled Mountain, Maine. Lateral view of male cercus. (Much enlarged.)

Fig. 2.—*Melanoplus mancus* (Smith). *Topotype.* Speckled Mountain, Maine. Caudal view of penis. (Greatly enlarged.)

Fig. 3.—*Melanoplus islandicus* Blatchley. Mechanicsville, Pennsylvania. Lateral view of male cercus. (Greatly enlarged.) (Same scale as Fig. 1.)

Fig. 4.—*Melanoplus islandicus* Blatchley. Mechanicsville, Pennsylvania. Caudal view of produced portions (not including base) of penis. (Same scale as Fig. 2.)

Fig. 5.—*Melanoplus celatus* Morse. *Paratype.* Wytheville, Virginia. Caudal view of penis.[20]. (Same scale as fig. 2.)

Fig. 6.—*Melanoplus serrulatus* new species. *Paratype.* Nantahala Mountains, North Carolina. Lateral view of male cercus. (Same scale as (Fig. 1.)

Fig. 7.—*Melanoplus serrulatus* new species. *Paratype.* Nantahala Mountains, North Carolina. Caudal view of penis. (Same scale as Fig. 2.)

Fig. 8.—*Melanoplus serrulatus* new species. *Paratype.* Nantahala Mountains, North Carolina. Lateral view of penis. (Same scale as Fig. 2.)

Fig. 9.—*Melanoplus divergens* Morse. *Paratype.* Jones Knob, Balsam Mountains, North Carolina. Lateral view of male cercus. (Same scale as Fig. 1.)

Fig. 10.—*Melanoplus divergens* Morse. *Paratype.* Jones Knob, Balsam Mountains, North Carolina. Lateral view of penis. (Same scale as Fig. 2.)

Fig. 11.—*Melanoplus payettei picropidzae* new subspecies. *Paratype.* Taft, Montana. Lateral view of male. (× 1¾.)

Fig. 12.—*Melanoplus payettei picropidzae* new subspecies. *Allotype.* Taft, Montana. Dorsal view of female. (× 1¾.)

Fig. 13.—*Melanoplus oklahomae* new species. *Allotype.* Nashoba, Oklahoma. Lateral vew of female. (× 1¾.)

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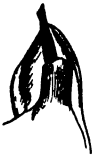
[20] The apex of the penis which curves strongly cephalad is consequently greatly foreshortened in this figure.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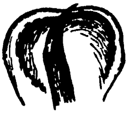
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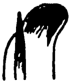
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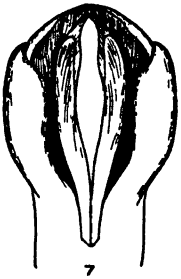
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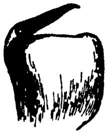
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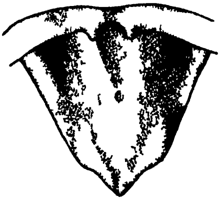
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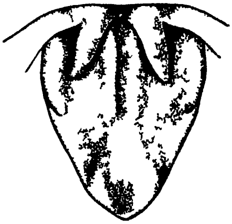
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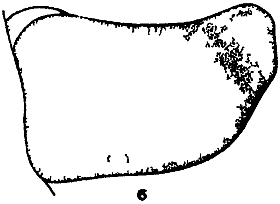
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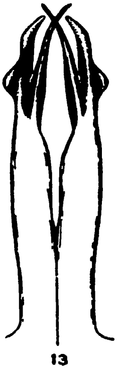
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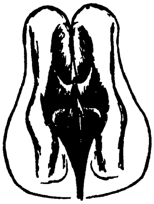
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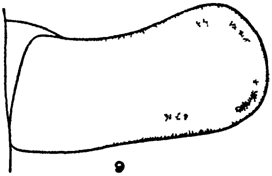
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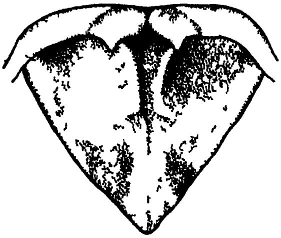
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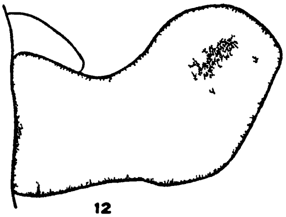
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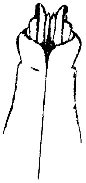
HEBARD—NORTH AMERICAN MELANOPLI



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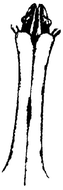

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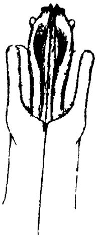

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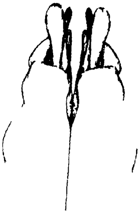

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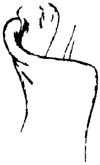

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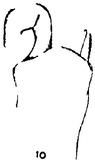

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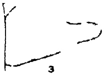

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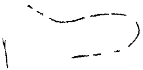

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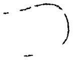

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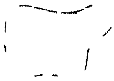

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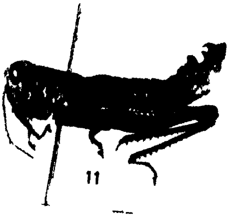

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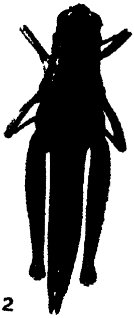

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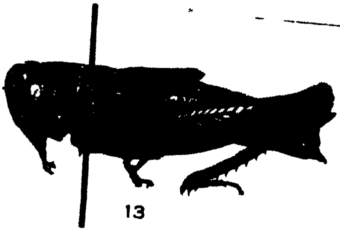

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HEBARD—NORTH AMERICAN MELANOPLI

# A REVISION OF THE GENUS MEGACHILE IN THE NEARCTIC REGION[1]

## PART VII[2]

## TAXONOMY OF THE SUBGENUS SAYAPIS

### (Hymenoptera: Megachilidae)

BY THEODORE B. MITCHELL

(Plates XII and XIII)

The species of the subgenus *Sayapis* superficially resemble those in *Chelostomoides*, principally because of the shape of the abdomen which is narrow and parallel-sided, with the sixth tergum more or less vertical in position, in both groups. The males of the two groups may be separated at once by the number of exposed abdominal sterna. *Sayapis* resembling all the other nearctic subgenera in having four, while *Chelostomoides* is unique in having the fourth sternum retracted, and hence only three visible externally. The females of *Sayapis* may be separated from those of *Chelostomoides* by the presence of a distinct cutting edge between the two middle teeth of the mandibles, although this is quite reduced in *pugnata*, the genotype. The mandibles in *Chelostomoides* females are entirely lacking such cutting edges, a feature which seems to be correlated with differences in their nest-building habits.

### Subgenus **SAYAPIS** Titus

*Gnathocera* Provancher (nec. Kirby), Nat. Can., xiii, p. 232, 1882. Provancher, Fauna Ent. Can. Hym., p. 716, 1883.

*Megachile*, Provancher, Add. Fauna Ent. Can., Hym., p. 323, 1888. Dalla Torre, Cat. Hym., x, p. 417, 1896.

*Ceratias*, Robertson (nec. Kroy), Trans. Am. Ent. Soc., xxix, p. 172, 1903.

*Sayapis*, Titus, Proc. Ent. Soc. Wash., vii, p. 154, 1905.

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[1] Contribution from the Department of Zoology and Entomology, North Carolina State College, published with the approval of the Director of the North Carolina Experiment Station as Paper No. 95 of the Journal Series.

[2] Parts I, II, III, IV, V and VI, Trans. Am. Ent. Soc., lix, pp. 295-361, (1934); lxi, pp. 1-44, (1935); lxi, pp. 155-205, (1935); lxii, pp. 117-166, (1936); lxii, pp. 323-382, (1937); lxiii, pp. 45-83, (1937).

Tongue.—Second joint of labial palpus subequal to or slightly longer than the first joint; third joint of maxillary palpus but very slightly longer than the second, much less robust, minutely pubescent (more coarsely so in *pugnata*).

*Female.*—Mandible 4-dentate, with a short cutting edge between the two middle teeth; basal joint of flagellum usually slightly longer than either the pedicel or the second joint; mid and hind metatarsi almost as broad and long as their tibiae; claws usually with robust basal teeth; abdomen parallel-sided, the terga more or less depressed both basally and apically, the basal grooves, however, usually lacking any indications of fasciae; dorsal surface of sixth tergum nearly vertical in position, somewhat convex or nearly straight, but the apex usually rather abruptly upturned, more or less shelf-like as seen in profile; sixth sternum quite uniformly and densely covered with short scopal hairs and entirely lacking an apical bare lip.

*Male.*—Mandible 3-dentate, with a robust inferior projection located somewhere between the middle and the base; basal joint of flagellum subequal in length to the pedicel, the second joint usually considerably longer; cheeks with a more or less pronounced bare concavity at the inferior angle, the lower margin of this produced to some degree, resulting in a more or less flattened spine which is directed toward the inferior mandibular projection; front coxae definitely spined, usually bare anteriorly, and with from one to several robust red bristles (none in *frugalis*); mid tibia with the usual apical spur; dorsal surface of sixth tergum vertical in position, with a definite carina which is usually distinctly emarginate medially, the apical margin of the tergum with obscure and rather variable teeth; seventh tergum relatively robust and conspicuous.

Male sternites: Fourth sternum exposed; medasternite of fifth sternum usually extensive, with usually fine and simple hairs or setae, often but obscurely demarked from the presternite, the poststernite closely united with the medasternite and often difficult to distinguish; medasternal areas of sixth sternum much modified, definitely separated medially, usually each one bilobate and bearing modified setae, the poststernal lobe extensive, usually not angulate.

Genital armature: Stipites relatively slender, usually but little dilated apically and without conspicuous hairs or setae; sagittae relatively robust, often more so than the stipites, and usually equalling the stipites in length; volsellae robust.

GENOTYPE: *Megachile pugnata* Say. [Orthotype.]

## *Key to Species of Sayapis*

### Females

1. Cheek with a prominent tubercle or spine on the lower posterior angle ........................................................2
   Cheeks not spined ..................................................3

2. Sixth abdominal tergum black pubescent, both dorsally and ventrally; more eastern .................................... *pugnata* Say
Sixth tergum in large part ochraceous pubescent above; western. *pugnata* var. *pomonae* Cockerell
3. Clypeus with prominent lateral platelike or spatulate protuberances. *fidelis* Cresson
Clypeus not protuberant .......................................... 4
4. Clypeus with conspicuous black pubescence ........................ 5
Pubescence of clypeus entirely pale .............................. 7
5. Vertex impunctate; clypeus with coarse and close punctures. *howardi* Cockerell
Vertex with fine close punctures, and clypeus with minute crowded punctures ......................................................... 6
6. Apical margin of clypeus very nearly straight; punctures of vertex and dorsum of thorax fine close and distinct .......... *frugalis* Cresson
Apical margin of clypeus bisinuate; punctures of dorsum of thorax minute, rather sparse and indistinct, the surface tessellate. *frugalis* var. *pseudofrugalis* new variety
7. Clypeal margin with a broad but shallow median emarginate area .... 8
Clypeal margin triangularly pointed medially, with a shallow emargination on each side ............................................ 9
8. Scopa entirely white; clypeus with strong, well separated punctures. *helianthi* Cockerell
Scopa black on sixth sternum and in part on the fifth; clypeus closely and rather finely punctate .......................... *pollicaris* Say
9. Pubescence entirely pale; all the tarsi ferruginous, contrasting with the dark tibiae .................................. *mellitarsis* Cresson
Discs of at least the apical abdominal terga with black pubescence; legs either entirely dark or entirely ferruginous, not of two contrasting colors ............................................................ 10
10. Legs entirely ferruginous .... ........................ *inimica* Cresson
Legs dark .... ................................................... 11
11. Pubescence of discs of second to fourth abdominal terga pale. *inimica* var. *jacumbensis* Mitchell
Discs of second to fourth abdominal terga with distinctly blackish or fuscous pubescence ............................................ 12
12. Very large (16-18 mm.); scopa yellowish. *inimica* var. *paludicola* Cockerell
Smaller; scopa white ...................... *inimica* var. *sayi* Cresson

### Males

1. Front tarsi entirely simple, dark ................................ 2
Front tarsi dilated, yellowish or ferruginous ....................... 3

2. Punctures of vertex and dorsum of thorax fine but distinct and rather close ........................................ *frugalis* Cresson
   Punctures of vertex and dorsum of thorax sparse and very minute and indistinct, the surface tessellate.
   *frugalis* var. *pseudofrugalis* new variety
3. Mid femur with an acute submedian ventral tooth ....*dentipes* Vachal
   Mid femur not toothed ........................................4
4. Metatarsal scale produced apically fully to the tip of the third joint ..5
   Apex of the metatarsal scale not attaining the tip of the third joint ..6
5. Mid metatarsi broadly dilated, but dark in color ........*pollicaris* Say
   Mid metatarsi narrow; all the tarsi ferruginous, contrasting with the dark tibiae ..................................*mellitarsis* Cresson
6. Cheeks, vertex and dorsum of thorax entirely impunctate.
   *howardi* Cockerell
   Cheeks, vertex and dorsum of thorax with distinct though often fine punctures ..............................................7
7. Apex of the metatarsal scale fully reaching the tip of the second joint; anterior fringe on the lower margin of the scale black only on the basal third ..............................................8
   Apex of the metatarsal scale not attaining the tip of the second joint; anterior fringe on the lower margin of the scale either entirely light or dark for entire length .....................................9
8. Pubescence of fifth abdominal tergum white ..............*pugnata* Say
   Pubescence of fifth tergum golden ....*pugnata* var. *pomonae* Cockerell
9. Metatarsal scale large and conspicuous, more reddish, boat-shaped; pubescence almost entirely light, including that on abdomen.
   *fidelis* Cresson
   Metatarsal scale relatively small and inconspicuous, ivory-color, considerably flattened and deeply excavated; dorsum of thorax and abdominal terga with definitely black pubescence ...............10
10. Legs entirely ferruginous ............................*inimica* Cresson
    Legs dark ....................................................11
11. Metatarsal scale distinctly longer than second and third joints combined ...................................*inimica* var. *sayi* Cresson
    Metatarsal scale short, barely as long as the second and third joints combined .......................*inimica* var. *jacumbensis* Mitchell

**Megachile (Sayapis) dentipes Vachal** (Pls. XII and XIII.)

*Megachile dentipes* Rev. d'Ent., XXVIII, p. 12, 1909. Cockerell, Ann. Mag. Nat. Hist., (8), XIII, p. 427, 1914. Mitchell, Trans. Am. Ent. Soc., LVI, p. 182, 1930.

*Megachile poculifera* Cockerell, Proc. U. S. Nat. Mus., LV, p. 217, 1920. Cockerell, Proc. U. S. Nat. Mus., LXIII, Art. 8, p. 1, 1923. Cockerell, Proc. Calif. Ac. Sc., (4), XII, p. 548, 1924.

*Male.*—Size: Length 11 mm.; breadth of abdomen 3 mm.; anterior wing 8 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin with a broad shallow median indentation in the center of which is a minute tubercle; mandible 3-dentate, the inferior projection subbasal, robust, the apex somewhat recurved, double as seen with the mandibles open; basal joint of flagellum subequal to pedicel, the second joint somewhat longer, the apical one slightly flattened but hardly dilated; lateral ocelli slightly nearer eyes than to edge of vertex; vertex flattened; cheeks subequal to eyes in width, the inferior angle slightly concave but bare only in part, the lower margin of the concavity produced into a somewhat flattened and rather short blunt spine; front coxae bare anteriorly, each with an oblique row of robust red bristles in front of the long slender spine; front femora slender; front tarsi broadly dilated and flattened, the metatarsus longer than the two following joints combined, its anterior margin produced into a very large deeply hollowed scale, the outer portion of which is prolonged almost to the tip of the second joint, the outer face near the base quite deeply concave; mid femur modified, with a sharp tooth on the lower margin midway from base to apex; mid and hind metatarsi slender; abdomen parallel-sided, the terga depressed apically, more deeply so laterally; carina of sixth tergum irregularly spinose or crenulate, resulting in the obscuring of the small median emargination, a deep pit just above the emargination, apical margin of the tergum with very low and inconspicuous median carinate teeth, the lateral teeth entirely lacking; seventh tergum barely visible, rather obtuse.

Sternites: Lateral portions of fifth presternite longer than broad, produced and rounded apically, the median portion linear, the medasternite quite extensive, rather closely covered with fine short hairs and quite distinctly demarked from the presternite, the poststernal strip straight, with a pair of narrow truncate projections on each side of the median third; lateral portions of sixth presternite somewhat longer than broad, the medasternal areas extensive, narrowly separated medially, each trilobate laterally, with a basal elongate lobe which is rounded at its tip and is covered with obscure pubescence, a wing-like apical lobe which is covered and fringed apically with elongate setae, and between these an elongate and oblique lateral lobe which is covered with short fine setae, the poststernal lobe extensive, triangular, with truncate apex, eighth sternum abruptly narrowed toward apex, the tip of which is broadly rounded and abruptly reflexed.

Genital armature: Stipites gradually narrowed above base, only very slightly dilated toward the obliquely compressed tips which have a limited apical area on the inner surface which is short setose; sagittae quite robust and straight, about equalling the stipites in length; volsellae robust, broad, the apex abruptly narrowed into an acute submedian projection.

Puncturation: Fine and close on face, cheeks and pleura above; rather widely separated on vertex, mesonotum, and scutellum, the vertex shining, the thorax dorsally dull; close but more coarse on pleura below; fine on abdomen, more indistinct and close basally, more distinct and definitely separated on the more apical shining terga, but the sixth rugoso-punctate.

Color: Black; antennae piceous; tegulae yellowish-hyaline marginally; wings lightly infuscated basally, more deeply so apically, and quite deeply so in radial cell, the nervures largely fuscous; tarsi more or less reddish, the front tarsi ivory or pale yellowish, the second joint with a rounded blackish spot beneath, the three basal joints with two or three dark lines extending from base to apex along the margins; spurs yellow.

Pubescence: White on head, thorax, and first abdominal segment with no dark admixture evident; second to fifth abdominal terga with black pubescence, short on the more basal terga, longer and upstanding on the fifth, the sixth with very fine and sparse whitish pubescence; second to fifth terga with entire white apical fasciae; front tarsal fringe white above, golden-brown beneath, and tipped with the same color above.

*Type.*—Male; Mendoza, [Mus. Hist. Nat. Paris].

*Range.*—Texas, south through Mexico and South America as far as Paraguay, June in Texas.

Two specimens from within our limits are now at hand; one labelled April, with no locality record, the other from Brownsville, Texas, in June.

**Megachile (Sayapis) fidelis** Cresson (Pls. XII and XIII.)

*Megachile fidelis* Cresson, Trans. Am. Ent. Soc., VII, p. 120, 1878. Cockerell, Denison Univ. Bull., XI, p. 65, 1898. Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 8, 1900. Friese, Das Tierr., Lfg. 28, Apidae I, p. 236, 1911. Cresson, Mem. Am. Ent. Soc., I, p. 118, 1916.

*Megachile fidelis* var. *concinnula* Cockerell, Entomologist, XXXII, p. 158, 1899.

*Megachile newberryae* Cockerell, Entomologist, XXXIII, p. 244, 1900.

*Megachile nivalis* (male) Friese, Zeit. Hym. Dipt., III, p. 246, 1903.

*Female.*—Size: Length 11-13 mm.; breadth of abdomen 3-4 mm.; anterior wing 8-9 mm.

Structure: Face considerably broader than long; eyes subparallel; clypeus flat above, with a conspicuous flattened spatulate protuberance at each extreme side, the margin between these excavated, polished and impunctate, with a median carinate spine-like projection; mandible 4-dentate, a cutting edge between the two middle teeth, all the teeth conspicuous; basal joint of flagellum subequal in length to both the pedicel and the second joint; lateral ocelli slightly nearer each other than to eyes, and slightly nearer eyes than to edge of vertex; vertex nearly flat; cheeks broader than eyes; metatarsi slightly shorter and narrower than their tibiae; abdomen long and narrow, parallel-sided, the terga deeply grooved basally and rather deeply depressed apically, the sixth tergum more or less rounded in dorsal aspect, in profile slightly convex to the abrupt, shelf-like apical lip; sixth sternum rounded, uniformly covered with scopal hairs.

Puncturation: Fine and very close over entire head and thorax, and for the most part on the abdomen, but becoming slightly more coarse to the fifth tergum.

Color: Black; antennae beneath more piceous; tegulae, wing nervures and spurs brownish-ferruginous; wings pale fuliginous.

Pubescence: Ochraceous in general aspect, but more whitish on cheeks and pleura; fuscous on vertex, mesonotum, scutellum and second to fifth abdominal terga medially, becoming ochraceous on the terga laterally, and the terga with conspicuous entire dense pale ochraceous apical fasciae; sixth tergum entirely covered with pale ochraceous tomentum, with no dark admixture; scopa entirely pale ochraceous.

*Male.*—Size: Length 10-12 mm.; breadth of abdomen 3-4 mm.; anterior wing 6.5-8 mm.

Structure: Face about as broad as long; eyes slightly convergent below; clypeal margin with a broad shallow median emargination; mandible 3-dentate, inferior projection acute, submedian, double as seen with the mandible open; basal joint of flagellum subequal to pedicel, the second joint considerably longer, the apical one slightly flattened and just perceptibly dilated; lateral ocelli slightly nearer edge of vertex than to eyes; vertex nearly flat; cheeks about equal to eyes in width, with a bare concavity at inferior angle, the lower margin of which is produced into a flat triangular spine; front coxae bare and shining anteriorly, each with a pair of contiguous stout red bristles in front of the slender moderately long spine; front femur slender; front tarsi dilated and flattened, the metatarsus produced anteriorly into a very large deeply concave scale which is produced apically nearly to the tip of the second joint; mid and hind metatarsi slender and relatively long; abdomen parallel-sided, the third to fifth terga slightly depressed apically; carina of sixth tergum with a small but usually deep median emargination, more or less crenulate laterally, with a median pit above the emargination, apical margin of the tergum with hardly evident teeth; seventh tergum rounded apically.

Sternites: Lateral portions of fifth presternite very narrow, the median portion short linear, medasternite very extensive, only obscurely demarked from the presternite, covered with very fine setae, the posternal strip with a broad median produced area which is slightly incurved medially; lateral portions of sixth presternite fully twice as long as broad, the medasternal areas distinctly separated medially, each one bilobate, with a more ventral and basal lobe which is broad and very short, covered with fine hairs, a more dorsal and apical lobe narrower but more extensive and bearing numerous curved and quite robust setae apically, the poststernal lobe extensive, broadly triangular with a truncate apex.

Genital armature: Stipites rather slender, quite abruptly narrowed above base, more or less compressed toward the apex, but the tip narrowly rounded; sagittae relatively straight, about as long and as robust as the stipites; volsellae robust, rounded apically, but the tip very slightly incised.

Puncturation: Quite fine and close over most of head and thorax, but more distinctly separated on vertex laterally; fine and close on abdomen basally, becoming more distinct and deep but still rather close, to the fifth tergum, minute and densely crowded on the sixth.

Color: Black; antennae beneath and tegulae reddish-piceous; wings pale transparent-fuliginous, darker apically and in radial cell, the nervures ferruginous; front tarsi yellowish except for the quite deeply ferruginous metatarsal scale and the dark apical joint, the second and third each with a dark spot beneath; mid and hind legs, as also the front femora and tibiae, blackish; spurs yellow.

Pubescence: White or pale ochraceous on head, thorax and basal abdominal segment, but vertex and mesonotum usually with some intermixture of fuscous hairs; second to sixth terga more or less black pubescent, tending to whitish or ochraceous on the second, fifth and sixth in some specimens; second to fifth terga with entire, white or ochraceous, apical fasciae; front metatarsal scale fringed for entire length on inner anterior margin with short blackish pubescence, the posterior fringe white, tipped with brown beneath.

*Type*.—Male; Colorado, [A.N.S.P., no. 2460].

*Range*.—California and Oregon, east to Nebraska, June to October. Definite records are as follows:

ARIZONA: 1♀, no locality record. 2♂, Oak Creek Canyon, 6000 ft., Aug., (F. H. Snow). Identified also from Mt. Lemon, Santa Catalina Mts.

CALIFORNIA: 1♂, 1♀, no locality record. 2♂, 6♀, Altadana, July 6 and Aug. 2, 1934, (on *Aster* sp. and *Senecio douglasii*). 3♂, 4♀, Bluff Lake, San Bernardino Mts., July 15, and Aug. 23, 1932 and 1934.. 2♀, Carson Pass, 8000 ft., Sept. 2 and 3, 1933 and 1934, (G. E. Bohart). 1♂, 2♀, Florence L., Fresno County, July 1931. 3♀, Mill Creek, San Bernardino County, Aug. 31 and Sept. 1, 1930. 1♀, Rathbon Creek, San Bernardino Mts., Aug. 25, 1933. 4♂, 3♀, Takopah Valley, Sequoia National Park, Aug. 20-25, 1933, (on *Eriogonum wrightii, Helenium bigelovii* and *Rudbeckia californica*), (one ♀ caught entering hole in small log); (all Michener). 2♂, 1♀, Big Pines Camp, July 16, 1927, (Timberlake; on *Erigeron stenophyllus*). 1♀, Huntington Lake, July 27, 1919, 7000 ft., (E. P. Van Duzee). 1♂, Kings River Canyon, Fresno County, July 6, 1910, (E. C. Van Dyke). 1♂, 1♀, Lake Tahoe, Aug. 22, 1916 (L. Bruner). 1♂, 1♀, Los Angeles County, July and Aug., (Coquillett). 1♀, Loyds, Tulare County, Aug. 3, 1935, (Evans). 1♀, Mineral King, July 31, 1935, (G. E. Bohart). 1♀, Westwood Hills, Los Angeles County, July 27, 1935, (E. G. Linsley). Identified also from Placer County, Santa Clara County, Shuford Peak and Sonoma County.

COLORADO: 2♂, 2♀, no locality record. 2♂, Boulder, July 20, 1908, (S. A. Rohwer). 2♂, 3♀, Boulder County, July 27 to Aug. 13, (Custer and Hicks). 1♀, Jim Creek, near Boulder, July 25, 1922. Identified also from Colorado Springs, Glenwood Springs, and Ute Creek.

MONTANA: 1♂, 1♀, no locality record. Identified from Elkhorn Mts.

NEBRASKA: 1♂, Glen, Sioux County, 4,000 ft., Aug. 20, 1906, (L. Bruner). Identified also from War Bonnet Canyon, Sioux County.

NEVADA: 3♂, 1♀, no locality record.

NEW MEXICO: 2♀, Beulah, July 11, 1902, (W. P. Cockerell; on Helianthoid Compositae). 2♂, 1♀, Fort Wingate, July 30 to Aug. 16, 1908 and 1909, (John Woodgate). 1♂, Sandia Mts., 10,000 ft., Aug. 13, 1935, (Michener; on *Senecio*). 1♂, 10 miles east of Santa Fe, 7,250 ft., July 27, 1931, (Scullen). Identified also from Aztec.

OREGON: 1♀, no locality record. 1♂, 1♀, Corvallis, Aug. 9 and Sept. 7, 1921, (on *Cosmas*). 2♀, Corvallis, July 20, 1934 and Aug. 23, 1932, (on *Daucus carota*). 1♀, Corvallis, Sept 5, 1935, (G. Ferguson). 1♂, Crater Lake Park, Pole Bridge Meadow, 5900 ft., Aug. 11, 1935, (Scullen). 1♂, 1♀, Diamond Lake, 5182 ft., Aug. 16, 1935, (Scullen and Ferguson). 1♂, 3♀, Three Sisters, Scott Lake, 4650 ft., Aug. 10, 1926, (on *Aster*); 1♀, Willamette R., Sept. 3-7, 1932, (Scullen). Identified also from Forest Grove and Woodruff Meadows, Jackson County.

SOUTH DAKOTA: 1♀, Hot Springs.

UTAH: 1♀, Bryce Canyon, Aug. 10, 1931, (J. Wilson; on thistle).

Specimens of *fidelis* have also been identified from Idaho.

FLOWER RECORDS.—*Solidago californica, Cleome serrulata, Gutierrezia sarothrae, Helianthus petiolaris, Erigeron stenophyllus, Verbena* sp., *Cosmas, Daucus carota, Aster, Senecio douglasii, Eriogonum wrightii, Helenium bigelovii,* and *Rudbeckia californica.*

**Megachile (Sayapis) frugalis** Cresson (Pls. XII and XIII.)

*Megachile frugalis* Cresson, Trans. Am. Ent. Soc., IV, p. 266, 1872. Viereck, Can. Ent., XXXIV, p. 329, 1902. Cockerell, Can. Ent., XXXV, p. 215, 1903. Friese, Das Tierr., Lfg. 28, Apidae I, p. 238, 1911. Cockerell, Ann. Mag. Nat. Hist., (8), XI, p. 532, 1913. Cresson, Mem. Am. Ent. Soc., I, p. 119, 1916. Cockerell, Proc. Calif. Ac. Sc., (4), XII, p. 546, 1924.

*Female.*—Size: Length 12-13 mm.; breadth of abdomen 3.5 mm.; anterior wing 9 mm.

Structure: Face slightly broader than long; eyes very slightly convergent below; clypeus flat, apical margin with a salient rim over the median half, this either straight or slightly sinuate; mandible 4-dentate, with an additional inconspicuous tooth between the larger third and fourth teeth; basal joint of flagellum subequal to both the pedicel and the second joint; lateral ocelli slightly nearer each other than to eyes, and slightly nearer eyes than to edge of vertex; vertex nearly flat; cheeks subequal in width to eyes; metatarsi slightly shorter and distinctly narrower than their tibiae; abdomen narrow and parallel-sided, the terga quite deeply grooved basally, and deeply depressed apically; sixth tergum rounded apically in dorsal aspect, in profile convex to the rather abrupt apical lip; sixth sternum narrowed apically, the tip truncate, quite uniformly covered with scopal hairs.

Puncturation: Very fine and close on face and clypeus, and along posterior orbits, more distinct but close on vertex, and slightly more coarse on cheeks below; fine and close over most of thorax; minute on abdomen basally, becoming quite coarse and deep to the fifth tergum, close on all the terga medially, becoming slightly more scattered laterally; fine, close and deep on the sixth tergum.

Color: Black; antennae more piceous beneath; tegulae brownish-hyaline; wings transparent fuliginous, darker toward the apical angle, nervures ferruginous to fuscous; spurs dark ferruginous to piceous.

Pubescence: White on face, cheeks, pleura, propodeum, and first to fourth abdominal segments, very thin and inconspicuous on the abdomen except the basal segment; black on vertex, mesonotum, and fifth and sixth abdominal terga, the clypeus and scutellum with long conspicuous erect black hairs and short thin inconspicuous white pubescence; first to fifth terga with narrow white apical fasciae, thin or interrupted on the first, entire on the others; scopa white, black on the sixth sternum.

*Male*:—Size: Length 10-11 mm.; breadth of abdomen 3-3.5 mm.; anterior wing 7.5-8 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin with a very slight and shallow median emargination; mandible 3-dentate, inferior projection subbasal, acute and rather small; basal joint of flagellum subequal to pedicel, the second joint fully twice as long, the apical one neither dilated nor flattened; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks subequal to eyes in width, the lower angle slightly concave but not distinctly bare, the lower margin of the concave area produced into a short sharp spine; front coxae thinly pubescent anteriorly, entirely lacking bristles, the spines slender and of moderate length; front femora and tibiae slender; front tarsi simple, neither dilated nor flattened; mid and hind metatarsi slender; abdomen parallel-sided, the terga rather deeply depressed apically; carina of sixth tergum with a deep semicircular median emargination, irregularly spinose or crenulate on each side of this, a deep pit just above the emargination, lateral teeth of the apical margin of the tergum conspicuous and acute, the median teeth inevident; seventh tergum triangularly pointed.

Sternites: Lateral portions of fifth presternite very narrow apically, median portion linear, the medasternite very extensive, practically devoid of setae, and very obscurely demarked from the presternite, the poststernal strip obscure, but a pair of oblique elongate apical projections which delimit a median slightly incurved area may belong to the poststernite; lateral portions of sixth presternite longer than broad, each with a median sharp carina or point on its apical margin, the medasternal areas bilobate on each side of middle, separated medially, with only very obscure hairs or setae, the basal pair of lobes relatively short, extended laterally over the presternite by an acute wing-like expansion, the apical pair of lobes more extensive, triangular, outer angle of the triangle free, the poststernal lobe extensive, somewhat narrowed to the truncate tip.

Genital armature: Stipites very slender, slightly sinuate and compressed; sagittae considerably more robust than the stipites and about equally as long, the tip slightly enlarged; volsellae robust, subtriangular.

Puncturation: Fine and close on face, cheeks and pleura, slightly more coarse and more definitely separated on mesonotum and scutellum, and still more widely separated on vertex laterally; minute but rather distinctly separated on abdomen basally. the punctures becoming deeper and more coarse apically, close toward the median line, more widely separated laterally on the median terga, the sixth rugoso-punctate.

Color: Black; antennae and tegulae more piceous; wings rather deeply infuscated. at least over apical half, especially in radical cell, the nervures brownish to piceous; spurs piceous or blackish.

Pubescence: White on head, thorax. legs, and first to fourth abdominal segment, but clypeus with conspicuous black hairs intermixed with the white, and vertex, mesonotum and scutellum with intermixed black hairs; fifth and sixth terga with erect black hairs, but those on the fifth toward the base whitish; second to fifth terga with entire white apical fasciae; front tarsus with a short but distinct posterior white fringe.

*Type.*—Male; Texas (Belfrage), [U.S.N.M., no. 1780].

*Range.*—Florida, north to Virginia, west to Southern California, April to August. Definite records are as follows:

CALIFORNIA: 1♀, Los Angeles County, Sept. Identified from Pasadena and Sequoia Nat. Park.

DELAWARE: 1♀, no locality record.

GEORGIA: 1♀, no locality record. 2♂, 2♀, Tifton, May 19, 22, 1896.

MEXICO: 1♀, Lower California.

PENNSYLVANIA: 1♀, Lehigh Gap, June 3, 1901.

NORTH CAROLINA: 1♂, 2♀, Bryson City, June 10 & 17 and July 4, 1923, (J. C. Crawford; on *Tephrosia virginiana*). 1♀, Carolina Beach, June 12, 1930, (on legume). 1♂, 1♀, Merry Oaks, May 27, 1926, (on *Tephrosia*). 1♀, White Lake, May 20, 1934, (on *Opuntia*); (all Mitchell).

Specimens of *frugalis* have also been identified from the following localities: Arizona—Globe Hills, Santa Catalina Mts. and Tucson; Missouri—Atherton; Florida—Royal Palm Park; Texas—Brownsville and Cotulla; Virginia—Falls Church; and West Virginia—Monongalia County.

*Flower Records.* — *Tephrosia virginiana, Marrubium vulgare, Eriogonum fasciculatum,* and *Opuntia.*

**Megachile (Sayapis) frugalis** var. **pseudofrugalis** new variety

(Pl. XII.)

This name is proposed for the western form of *frugalis* which differs from the typical form in the east in having the vertex and dorsum of thorax almost impunctate, the surface being tessellated and the punctures very sparse and minute. In the female the clypeus is more distinctly bisinuate apically than in the typical form, while in the male, the apical teeth of the sixth tergum are more elongate and the seventh tergum is more conspicuous.

*Type.*—Male; Pine Valley, San Diego County, California, (W. J. Chamberlain), [Calif. Ac. Sc., no. 3620].

*Allotype.*—Female; Los Angeles County, California, (Coquillett), [U.S.N.M.].

*Paratypes.*—2 ♀, Sabino Basin, Santa Clara Mts., Arizona, Sept. 4, (C. H. T. Townsend), [Mitchell]. 1 ♀, California, [A.N.S.P.]. 2 ♀, Auburn, California, July 12, 1919, (L. Bruner), [Un. Nebr.]. 1 ♀, Descanso, San Diego County, California, Aug. 4, 1917, [Mitchell]. 1 ♂, Jacumba, San Diego County, California, Aug. 12, 1917, (on *Eriogonum fasciculatum*). 3 ♂, Los Angeles, California, (Coquillett), [U.S.N.M.]. 2 ♂, 3 ♀, Los Angeles, California, June 22 to July 5, 1926, (Hicks), [Hicks]. 1 ♀, Riverside, California, July 9, 1925, (Timberlake; on *Eriogonum fasciculatum*), [Timberlake]. 1 ♂, 3 ♀, Altadena, California, May 23 to Sep. 13, 1933. 2 ♀, Eagle Rock, California, July 1, 1936 (on *Lotus*). 1 ♂, Hospital Rock, Sequoia National Park, California, Sep. 4, 1933, (on *Eriogonum wrightii*). 1 ♀, La Crescenta, California, June 26, 1934, (on *Lotus scoparius*). 1 ♀, San Jacinto, California, Aug. 18, 1934, (on *Croton californicus*). 2 ♂, 1 ♀, Waterman Canyon, San Bernardino County, California, July 16, 1934, (on *Eriogonum fasciculatum*); (all Michener). 1 ♂, Putah Canyon, Solano County, California, June 4, 1936, (R. M. Bohart). 3 ♂, Westwood Hills, Los Angeles County, California, Aug. 11, 1935, (E. G. Linsley). 1 ♂, Wing Canyon, Napa County, California, 950 ft., Aug. 9, 1935, (P. H. Baldwin).

*Flower records.—Croton californicus, Eriogonum fasciculatum, E. wrightii* and *Lotus scoparius.*

**Megachile (Sayapis) howardi** Cockerell (Pls. XII and XIII.)

*Megachile howardi* Cockerell, Proc. U. S. Nat. Mus., LV, p. 216, 1920. (♂.)
Cockerell, Proc. Calif. Ac. Sc., (4), XII, p. 546, 1924.

The female originally described under this name is synonymous with *M.* (*Chelostomoides*) *zaptlana* Cresson. The male was made the type, however, and hence the name is valid. What appears to be the true female has come to hand recently and is described below for the first time.

*Female.*—Size: Length 15 mm.; breadth of abdomen 4 mm.; anterior wing 10 mm.

Structure: Face somewhat broader than long; eyes subparallel; clypeus short, the apical margin very slightly incurved on each side of middle; mandibles 4-dentate, but the inner tooth truncate and slightly emarginate, approaching a 5-dentate condition, a cutting edge between the two middle teeth; basal joint of flagellum just perceptibly shorter than pedicel or second joint; lateral ocelli nearer eyes than to edge of vertex and slightly nearer each other than to eyes; vertex slightly rounded; cheeks broader than eyes; abdomen parallel-sided, second to fifth terga slightly grooved across base, the sixth descending to a quite abrupt apical lip, the sixth sternum well covered with scopal hairs.

Puncturation: Very shallow and indistinct on vertex, cheeks, mesonotum, scutellum and basal segment of abdomen, the surface tessellate; fine and close on pleura and over most of abdomen, crowded on the sixth tergum; very coarse and close on clypeus.

Color: Black; antennae and tegulae more piceous; wings hyaline, slightly clouded apically and along costal margin of radical cell; spurs yellowish to ferruginous.

Pubescence: White on face, cheeks, pleura, legs and segments one to four of abdomen; white, with longer intermixed black hairs on vertex, mesonotum and scutellum; black on clypeus, mandibles and the fifth and sixth terga, long and erect on the clypeus; scopa creamy-white, black on the sixth sternum.

*Male.*—Size: Length 12 mm.; breadth of abdomen 3.5 mm.; anterior wing 8 mm.

Structure: Face about as broad as long; eyes slightly convergent below; clypeal margin entire; mandible 3-dentate, the inferior projection robust, subbasal, the apex double as seen with the mandibles open, but the apical emargination almost obscured by the dense pubescence; basal joint of flagellum subequal to pedicel, the second joint about twice as long, the apical one slightly dilated and flattened; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks slightly broader than eyes, inferior angle with a shallow concavity which has the lower margin produced into a short flattened triangular spine; front coxae bare and flattened anteriorly, each with a single robust suberect red bristle in front of the long slender compressed spine; front femur slender; front tibia considerably broadened apically; front tarsi broadly dilated and flattened, the metatarsus subequal to the following two joints combined, its anterior margin produced into an extremely large and deeply hollowed scale which is produced apically nearly to the tip of the second joint; mid and hind metatarsi slender; abdomen parallel-sided, the terga depressed apically; carina of sixth tergum with a median semicircular emargination, slightly and irregularly crenulate on each side, a deep pit just above the emargination, the median carinate teeth of the apical margin of the tergum barely evident, the lateral teeth inevident; seventh tergum obscurely triangular, concave just above tip.

Sternites: Lateral portions of fifth presternite much narrowed apically, broad basally, median portion very short, almost linear, the medasternite not so extensive, bearing numerous setae along the basal area, but these disappearing medially and apically, the poststernal strip unmodified and nearly straight; lateral portion of sixth presternite slightly, longer than broad, with a pronounced oblique median apical carina, the medasternal areas widely separated, each one bilobate, the basal lobe transverse and elongate, almost rod-like, bearing along its apical margin numerous robust curved setae, the apical lobe extensive, prolonged and acute laterally, bearing along its apical half numerous very robust flexed capitate setae which are directed more basally and laterally, those on the basal lobe directed apically and medially, the poststernal lobe very extensive, rectangular, with a straight apical margin.

Genital armature: Stipites gradually narrowed above base, obliquely compressed and very slightly dilated beyond this, the tip slightly knobbed with a slender curved dorsal projection which is finely setose; sagittae straight and rather robust, about equalling the stipites in length, the tips slightly flexed and dilated; volsellae robust, obliquely truncate apically, the outer apical angle acute, the inner one rounded.

Puncturation: Head and thorax tessellate, but with hardly discernible punctures, abdomen practically impunctate basally, but the punctures becoming distinct and quite deep, though fine and close, to the fifth tergum, the sixth finely rugoso-punctate.

Color: Black; antennae beneath and tegulae reddish-piceous; wings hyaline, but quite distinctly clouded apically and in radial cell, the nervures ferruginous; legs, except for the front tarsi, black, the front tarsi yellow, second and third joints with dark spots beneath, and all of the joints with two or three parallel dark stripes, the metatarsi somewhat darkened above along the posterior margin; front and mid spurs more yellowish, the hind spurs darker, almost piceous.

Pubescence: White on head, thorax, and first to fourth abdominal segments, but vertex and mesonotum with some shorter inconspicuous dark hairs intermixed with the white, and clypeus with a few dark hairs occurring in a row across the upper margin; fifth and sixth terga black pubescent, the fifth quite densely so; second to fifth terga with entire white apical fasciae; front tarsal fringe white above, golden-brown beneath, and the latter visible through the white from above.

*Type.*—Male; San Jose de Guaymas, Mexico, April 10, (L. O. Howard), [U.S.N.M., no. 21686].

*Range.*—This species was originally described from Mexico, and is also recorded by Cockerell from Lower California. To these records can now be added the following records from the United States:

ARIZONA: 1♀, no locality record, [A.N.S.P.]. 3♀, Douglas, Aug. 15, 1930, (W. W. Jones), [Timberlake]. 1♀, Florence, Aug. 27, 1903, [A.N.S.P.].

CALIFORNIA: 2♂, five miles north of Indio, April 10, (on *Cercidium torreyanum* and *Prosopis juliflora*). 1♀, Palm Springs, May 11, 1935, (on *Acacia greggii*). 1♂, Palm Springs, April 10, 1936, (on *Cercidium torreyanum*); (all Michener). Also identified from Coachella Valley (May).

NEW MEXICO: 4♂, 1♀, Alamogordo, April 29, May 1 and June 7, 1902, [A.N.S.P.].

*Flower records.*—*Acacia greggii, Cercidium torreyanum* and *Prosopis juliflora.*

**Megachile (Sayapis) inimica** Cresson (Pls. XII and XIII.)

*Megachile inimica* Cresson, Trans. Am. Ent. Soc., IV, p. 267, 1872. Robertson, Trans. Ac. St. Louis, VII, no. 14, p. 350, 1897. Cockerell, Can. Ent., XXXV, p. 215, 1903. Friese, Das Tierr., Lfg. 28, Apidae I, p. 239, 1911. Cresson, Mem. Am. Ent. Soc., I, p. 120, 1916. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

This is a very variable species, especially as to color, both of the appendages and of the pubescence. Over most of its range the legs are black, but the type specimen is one of the red-legged form which occurs along the Gulf of Mexico. This must be considered the typical form, therefore, even though it is more restricted in distribution than var. *sayi*, the black-legged form.

*Female.*—Size: Length 13-16 mm.; breadth of abdomen 3-4 mm.; anterior wing 9-10 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeus flat, apical margin with a low median angle, and a smaller lateral angle on each side; mandible 4-dentate, a cutting edge between the two middle teeth, all the teeth conspicuous; basal joint of flagellum subequal in length to both the pedicel and the second joint; lateral ocelli subequally distant from each other and from eyes, much nearer eyes than to edge of vertex; vertex nearly flat; cheeks slightly broader than eyes; mid and hind metatarsi subequal in length and breadth to their tibiae; abdomen long and narrow, parallel-sided, the terga deeply grooved basally, the apical margins distinctly depressed; sixth tergum rounded in dorsal aspect, in profile slightly convex to the abrupt shelf-like apical lip; sixth sternum rounded, the apex subtruncate.

Puncturation: Fine and rather close on cheeks above, becoming slightly more coarse and more widely separated on cheeks below and on vertex; rather coarse but close on face and clypeus, and over most of thorax, although slightly separated in center of mesonotum; fine and close on abdomen basally, becoming quite coarse, deep and well separated to the fifth tergum, the sixth more rugoso-punctate.

Color: Black; antennae beneath more fuscous; tegulae, legs and spurs bright ferruginous; wings deep fuliginous, the nervures fuscous.

Pubescence: Pale ochraceous, fading to whitish below; fuscous and thin on vertex and mesonotum, short and fuscous on abdominal terga; scutellum with short pale pubescence intermixed with long erect fuscous hairs; first to fifth terga with dense, entire, pale ochraceous apical fasciae; sixth tergum without pale pubescence; scopa whitish or very pale yellowish, black on the sixth sternum.

*Male.*—Size: Length 11-14 mm.; breadth of abdomen 3.5-4 mm.; anterior wing 7.5-8.5 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin with a shallow rounded median emargination; mandible 3-dentate, the inferior projection triangular, subbasal, the apex with a dense tuft of pubescence; basal joint of flagellum subequal to pedicel, the second joint slightly longer, the apical one flattened, but hardly dilated; lateral ocelli slightly nearer eyes than to edge of vertex; vertex nearly flat; cheeks about equal to eyes in width, inferior angle with a shallow and rather small bare concave area more or less obscured by the surrounding pubescence, the lower margin produced into a short flat triangular spine; front coxae largely bare or very thinly pubescent anteriorly, with a small patch of stout red bristles in front of the slender moderately long spines; front femora rather slender; front tarsi dilated and flattened, the metatarsus slightly shorter than the second and third joints combined, but its anterior margin produced into a deeply hollowed scale which projects apically to the base of the third joint (but the scale relatively inconspicuous as compared to the same structure in *pugnata, pollicaris, fidelis,* etc); mid and hind metatarsi slender; abdomen parallel-sided, second to fifth terga quite deeply depressed apically; carina of sixth tergum usually with a small median emargination, but this sometimes obscured by the irregular crenulations on each side, a deep pit located just above the emargination, the apical margin of the tergum with very low and inconspicuous median carinate teeth, the lateral teeth absent; seventh tergum robust, usually obtuse, or with a very fine median point, concave just above this.

Sternites: Lateral portions of fifth presternite much narrowed apically, broad basally, median portion short, almost linear, the medasternite not so extensive, sparsely covered with simple setae, those near the base medially quite robust, becoming very fine apically and laterally, the poststernal strip straight and unmodified; lateral portions of sixth presternite considerably longer than broad, their apical margins triangularly acute, the medasternal areas rather widely separated, obscurely bilobate, the basal lobe with an acute elongate lateral projection and well covered with long and robust but simple setae, the apical lobe more extensive, also with an acute lateral prolongation, the apical margin fringed with a double or triple row of robust, strongly flexed and slightly dilated setae, the poststernal lobe extensive, broad, truncate apically, the sides slightly oblique.

Genital armature: Stipites considerably constricted above base, slightly dilated beyond this, obliquely compressed toward the unmodified tips, more or less sinuate; sagittae straight and robust, the tips slightly flexed and dilated; volsellae robust, more elongate, the tips subacute.

Puncturation: Fine and close over entire head, thorax, and first two abdominal segments, although slightly separated on the vertex laterally; deeper and more distinctly separated on the third to fifth terga, the sixth rugoso-punctate.

Color: Black; antennae black or piceous; tegulae reddish-piceous; wings lightly infuscated, more deeply so apically and in radical cell, the nervures ferruginous to piceous; all the legs bright ferruginous, but the front tarsi ivory, the metatarsal scale somewhat darkened along anterior margin, the second and third joints with elongate darkened areas beneath and a pair of dark lines extending along posterior margins of the first to third joints beneath; spurs ferruginous.

Pubescence: White on head, thorax, and basal abdominal segment, but vertex and mesonotum medially largely black pubescent, and scutellum with intermixed dark hairs; second to sixth terga largely black pubescent, very short on the more basal segments, longer and more sparse on the fifth and sixth, with some tendency to becoming ochraceous or whitish; second to fifth terga with entire white apical fasciae; front tarsal fringe white, tipped with golden-brown beneath, the metatarsal scale fringed on both anterior margins with short brownish or ferruginous pubescence.

*Type.*—Female; Texas, [A.N.S.P., no. 2459].

*Range.*—The typical form is restricted to the Gulf coast, but its variants range from Florida, north to Pennsylvania, west to Idaho and California. It is in flight during February, March and April in Florida, from May to November, in Texas, from July to September in most other localities. Definite records are as follows:

FLORIDA: 1♀, S. Fla., (Mrs. Slosson). 1♀, Biscayne Bay. 1♀, Capron, Apr. 17. 1♂, 1♀, Flamingo, Apr. 13, 1923. 1♂, Key Biscayne, Miami. Feb. 15, 1925, (Graenicher). 1♀, Miami, (A. E. Wight). 1♀, No Name Key, Mar., 1898. 1♂, Sugar Loaf Key, Mar., 1898; (both C. N. Collins and C. L. Pollard).

TEXAS: 1♀, 1♂, no locality record. 1♂, Austin, May, 1933. 2♂, 3♀, Bexar County, Sept. 18-23, 1930, (H. B. Parks; on *Salvia ballolaeflora*). 3♂, 3♀, Bexar County, Apr. 28, June 12, Oct. 8 & 10, (Parks). 1♀, Lee County, Oct. 1910, (Birkmann). Identified also from Anholt, Austin, Fedor, New Braunfels, Sabinal and Uvalde.

*Flower records.*—The following note concerning the period of flight, flower visiting habits, and nesting habits of this species was received from Mr. H. B. Parks, at San Antonio, Texas: "This bee was not seen during the last part of June, all of July and until late August, when a few females were captured, while working valley sage (*Salvia ballotaeflora* Benth.) and four males on *Vitex negundo incisa.* These were the only males seen. In September the females were common, collecting both pollen and nectar from *Laciniaria punctata* Kuntze. All through October and up to this date, November 6, the females have worked *Ximensia encelioides* Cav. abundantly for pollen and nectar. The females made their nests in ' worm holes ' in mesquite trees or mesquite fence posts. The holes are lined with circles cut from leaves of *Monisia pallida* Planch."

Graenicher records it as visiting *Crotalaria pumila, Bidens leucantha* and *Borrichia frutescens.*

**Megachile (Sayapis) inimica** var. **sayi** Cresson

*Megachile sayi* Cresson, Trans. Am. Ent. Soc., VII, p. 119, 1878. Friese, Das Tierr., Lfg. 28, Apidae I, p. 246, 1911. Cresson, Mem. Am. Ent. Soc., I, p. 129, 1916.

*Megachile heterodonta* Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 18, 1900.

*Ceratias sayi* Robertson, Trans. Am. Ent. Soc., XXIX, p. 172, 1903.

*Megachile sayi* var. *heterodonta* Cockerell, Proc. U. S. Nat. Mus., XL, p. 254, 1911.

*Megachile sayi* var. *sancta* Cockerell, Ann. Mag. Nat. Hist., (8), X, p. 487, 1912.

*Megachile* (*Sayapis*) *sayi* Viereck, Conn. Nat. Hist. Surv., Bull., XXII, p. 742, 1916.

Legs brownish-ferruginous or black; wings dusky apically.

Cockerell considered *sayi* to be the red-legged form, and used the color of the legs as a contrasting character between it and the forms he named *heterodonta* and *sancta*. These latter seem to be nothing more than individual variations of the dark-legged form.

RECORDS.—Arizona: 1♂, Douglas, Aug. 20, 1933, (W. W. Jones). 3♂, Huachuca Mts., Carr County, Aug. 5 & 6, 1924, (E. P. Van Duzee). 5♂, 5♀, Oak Creek Canyon, 6000 ft., Aug., (F. H. Snow). 1♂, 1♀, Ramsey Canyon, Huachuca Mts., (W. H. Mann). Identified also from Graham Mt., Hereford, Palmerlee and Santa Catalina Mts.

CALIFORNIA: 1♀, Hermit Valley, San Jacinto Mts., Aug. 17, 1934, (Michener).

COLORADO: 2♀, Boulder County, Aug. 10 & 13, 1925, (Hicks). 1♀, Hubbard Ranch, Elbert, July 29, (Figgins; an *Gilia*). Identified also from La Junta, Palisades and Pueblo.

FLORIDA: 1♀, Cutler, Nov. 2, 1927, (Graenicher). Identified also from Miami.

GEORGIA: 1♂, no locality record. Identified from Valdosta.

ILLINOIS: 2♀, no locality record. 4♀, Palos, July 30, Sep. 2 & 5, 1931 and 1932, (H. Pearson).

KANSAS: 1♀, no locality record. Identified from Anderson County and Baldwin.

MEXICO: 2♀, Guadalajara, Aug. 20 & Sep. 14, (McLendon).

NEBRASKA: 1♀, Glen, Sioux County, Aug. 8, 1905. Identified also from Carns, Curtis, Louisville, Omaha, War Bonnet Canyon, and West Point.

NEW MEXICO: 2♀, White Oaks, July 31 & Aug. 2, 1902.

NORTH CAROLINA: 1♀, Castle Hayne, Sep. 12, 1928. 3♀, Hoffman, Sep. 5, 1931, (on *Coreopsis*). 1♂, Marion, July 27, 1924, (on *Coreopsis stellata*). 1♂, 1♀, Marion, Aug. 31, 1929, (on *Vernonia glauca*). 1♀, Marion, July 25, 1936, (on *Coreopsis*). 1♀, Pilot Mt., July 19, 1931. 1♂, Raleigh, July 26, 1932. 1♀, Swannanoa, Sep. 3, 1924, (on *Chrysopsis mariana*). 1♀, Wilmington, Sep. 11, 1928.

SOUTH CAROLINA: 2♀, Georgetown, Aug. 1, 1934, (Mitchell). Identified also from Charleston.

Specimens of *sayi* have been identified also from the following additional localities: Arkansas—Marion County; Idaho—Paris; Indiana—Lafayette; Iowa—Sioux City (reared from mine in apple wood); Ohio—Columbus, Marietta and Smithfield; Pennsylvania—Mt. Holly Springs; and Virginia—Falls Church.

*Flower records.* — *Chrysopsis mariana, Cleome* sp., *Coreopsis stellata, Gilia* sp., *Helianthus petiolaris, Heliopsis helianthoides, Melilotus alba, Strophostyles* sp., *Verbena* sp., *Vernonia fasciculata* and *V. glauca.*

**Megachile inimica** var. **paludicola** Cockerell

*Megachile sayi* var. *paludicola* Cockerell, Proc. U.S.N.M., XL, p. 254, 1911.

Large and robust (16-18 mm.); scopa pale yellowish, black on the sixth sternum.

ARIZONA: 1 ♀, Palmerlee.

COLORADO: 1 ♂, 1 ♀, Elbert, Aug. 11 (Figgins).

NEBRASKA: 1 ♀, Glen, Sioux County, Aug. 5, 1905.

TEXAS: 1 ♀, cotype, Hearns, July 23, 1906, (F. C. Bishop, at nests in bog).

**Megachile inimica** var. **jacumbensis** Mitchell (Pl. XII.)

*Megachile inimica* var. *jacumbensis* Mitchell, Psyche, XXXIV, p. 109, 1927.

Smaller than the typical form (about 11 mm.) black-legged, and with the puncturation much more fine and sparse on cheeks and vertex. In the male the front metatarsal scale is short, not nearly attaining the basal part of the third joint. In the female the pubescence on the discs of the median abdominal segments is pale, in contrast to the quite distinctly blackish pubescence of those terga in *sayi*.

CALIFORNIA: 1 ♂, 1 ♀, Antioch, Sept. 6 and 10, 1936, (G. E. and R. M. Bohart). 2 ♂, Jacumba, San Diego County, Aug. 12, 1917, (at *Eriogonum fasciculatum*). 1 ♀, Mission Valley, Sept. 11, 1927, (J. Van Boeker). 1 ♂, San Diego, Aug. 25, 1927, (J. Van Bocker). Identified also from Warren.

MEXICO: 1 ♀, Lower California.

*Flower records.—Eriogonum fasciculatum.*

**Megachile (Sayapis) mellitarsis** Cresson (Pls. XII and XIII.)

*Megachile mellitarsis* Cresson, Trans. Am. Ent. Soc., VII, p. 121, 1878. Friese, Das Tierr., Lfg. 28, Apidae I, p. 241, 1911. Cresson, Mem. Am. Ent. Soc., I, p. 123, 1916.

*Megachile terrestris* Cockerell (nec. Schrottky,) Ann. Mag. Nat. Hist., (8), I, p. 260, 1908.

*Megachile geophila* Cockerell, Can. Ent., XL, p. 460, 1908.

The similarity in coloration of the tarsi, and the agreement as to range, leaves little doubt that the two sexes of this species as given here have been correctly associated.

*Female.*—Size: Length 11-14 mm.; breadth of abdomen 3.5-4.5 mm.; anterior wing 8.5-10 mm.

Structure: Face slightly broader than long; eyes somewhat convergent below; clypeus flat, apical margin with a moderately deep rounded emargination on each side of the middle; mandible 4-dentate, a short cutting edge between the two middle teeth; basal joint of flagellum very slightly longer than either the pedicel or the second joint, these latter subequal; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks somewhat broader than eyes; metatarsi distinctly shorter and slightly narrower than their tibiae; abdomen parallel-sided, second to fourth terga deeply grooved basally and quite deeply depressed apically, the sixth tergum rounded in dorsal aspect, in profile slightly convex to the rather abrupt apical lip; sixth sternum rounded.

Puncturation: Fine and close, almost crowded, over entire head and thorax, slightly more distinct on vertex laterally and in center of mesonotum; very fine on abdomen, crowded basally, but becoming more distinct to the fifth tergum, very fine and crowded on the sixth.

Color: Black; antennae rather reddish-piceous; tegulae somewhat paler than antennae, nearly ferruginous; wings transparent yellowish, more brownish apically, the nervures ferruginous to fuscous; spurs and all the tarsal joints pale ferruginous, contrasting with the otherwise dark leg joints.

Pubescence: Whitish on cheeks and pleura (or in some specimens over entire head and thorax), otherwise pale ochraceous, with no dark admixture over entire body, but first to fifth abdominal terga with rather conspicuous entire whitish apical fasciae; scopa entirely pale yellowish.

*Male.*—Size: Length 11 mm.; breadth of abdomen 3.5 mm.; anterior wing 8 mm.

Structure: Face about as broad as long; eyes slightly convergent below; clypeal margin slightly outcurved, faintly crenulate medially; mandible rather slender, 3-dentate, inferior projection submedian, acute, double as seen with mandibles open; basal joint of flagellum subequal to pedicel, the second joint somewhat longer, the apical one flattened and quite broadly dilated; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks subequal to eyes in width; with a bare shallow concavity at inferior angle, the lower margin of which is produced into a flattened triangular spine; front coxae bare anteriorly, each with three or four contiguous long suberect red bristles just in front of the long slender spine; front femora slender; front tarsi broadly dilated and flattened, the metatarsus slightly shorter than the two following joints combined, but its anterior margin produced into an extremely large and deeply hollowed scale which is narrowly produced apically nearly to the tip of the third joint, the inner margin broadened apically so that it overlies the concavity in part like a shelf, the outer margin slightly flexed at this point; mid and hind metatarsi slender; abdomen parallel-sided, the third to fifth terga distinctly depressed apically, more so toward the sides; carina of sixth tergum with the median emargination inconspicuous, obscured by the irregular spines or crenulations at each side which are nearly equal in size to the emargination, a deep pit just above it, apical margin of the tergum with no evident median or lateral teeth; seventh tergum rounded with a concavity just above the apex.

Sternites: Lateral portions of fifth presternite narrowed apically, median portion linear, the medasternite obscurely demarked, quite extensive, with fine and sparse setae, the poststernal strip with a pair of short robust truncate apical protuberances which delimit a broad and deep rounded median emargination; lateral portions of sixth presternite longer than broad, with a robust subapical protuberance, the medasternal areas widely separated, bilobate, the more basal lobe obscure, elongate laterally, almost linear, fringed apically with inconspicuous hairs, the more apical lobe extensive, its latero-apical angle prolonged and acute, covered with long flexed and dilated setae, the poststernal lobe extensive, slightly longer than broad, slightly incurved medially, the apical angles rather distinct but not acute.

Genital armature: Stipites rather slender, considerably constricted above base, dilated and sparsely setose medially, attenuate apically; sagittae robust, straight, about equalling the stipites in length; volsellae robust, irregularly rounded apically.

Puncturation: Very fine and close over most of head, thorax and basal abdominal segments, but the punctures quite distinctly separated on vertex laterally; deeper and more distinct on the more apical abdominal terga, but still rather close, the sixth finely rugoso-punctate.

Color: Black; antennae more piceous beneath; tegulae yellowish-ferruginous, with obscure piceous blotches; wings yellowish-hyaline, more distinctly clouded apically, the nervures ferruginous; all the femora and tibiae black, but the apices of all the tibiae and the mid and hind tarsi entirely ferruginous; front tarsi more yellowish, the second joint with a dark spot beneath; spurs yellow.

Pubescence: Entirely pale over entire insect, without dark admixture, more ochraceous on vertex and on abdominal segments, otherwise white, the second to fourth terga with narrow entire white apical fasciae, but the fifth definitely lacking this fascia; front tarsal fringe white, tipped with golden-brown beneath.

*Type.*—Male; Colorado, [A.N.S.P., no. 2462].

*Range.*—California, New Mexico, Nevada and Colorado, north to British Columbia, June to September. Definite records are as follows:

CALIFORNIA: 1 ♀, Buck Creek, Modoc County, July 25, 1922, (C. L. Fox). 1 ♀, Davis Creek, Modoc County, July 11, 1922, (C. L. Fox).

COLORADO: 1 ♀, Boulder County, June 16, 1925, (Hicks).

OREGON: 1 ♀, Antelope Mts., Harney County, 6500 ft., July 3, 1931, (D. K. Frewing). 1 ♂, Drake Peak, Lake County, 8400 ft., July 26, 1930, (H. A. Scullen; on *Eriogonum* spp.). 1 ♀, Stein Mts., Harney County, June 7-11, 1922, (W. J. Chamberlin). 1 ♂, Warner Mts., Lake County, June 20, 1922, (E. C. Van Dyke). Identified also from Lava Lake.

WASHINGTON: 3♀, Yakima City, July 2-4, 1882, (Samuel Henshaw).

Additional specimens of *mellitarsis* have been identified from Westbank, British Columbia and from New Mexico.

*Flower records.—Aster* sp., *Eriogonum* sp.

**Megahile (Sayapis) pollicaris** Say (Pls. XII and XIII.)

*Megachile pollicaris* Say, Boston Journ. Nat. Hist., IV, p. 406, 1837. Leconte, Compl. Writ. T. Say, II, p. 782, 1859. Cresson, Trans. Am. Ent. Soc., IV, p. 264, 1872. Cresson, Trans. Am. Ent. Soc., VII, p. 120, 1878. Friese, Das Tierr., Lfg. 28, Apidae I, p. 244, 1911. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

*Megachile grandis* Cresson, Trans. Am. Ent. Soc., IV, p. 268, 1872. Cresson, Mem. Am. Ent. Soc., I, p. 120, 1916.

*Megachile pollicaris* var. *perezimia* Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 12, 1900. Cockerell, Proc. Calif. Ac. Sc., (4), XII, p. 548, 1924.

*Megachile vallorum* Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 18, 1900.

*Ceratias pollicaris* Robertson, Trans. Am. Ent. Soc., XXIX, p. 172, 1903.

*Megachile pereximia* Cockerell, Ann. Mag. Nat. Hist., (8), XIII, p. 430, 1914.

*Female.*—Size; Length 14-15 mm.; breadth of abdomen 4-5 mm.; anterior wing 9-10 mm.

Structure: Face slightly broader than long; eyes slightly convergent below; clypeus flat, apical margin gently outcurved medially, this area terminated on each side by a slight protuberance; mandible 4-dentate, a cutting edge between the second and third teeth; basal joint of flagellum subequal in length to both the pedicel and the second joint; lateral ocelli subequally distant from each other and from eyes, nearer the eyes than to edge of the vertex; vertex flat; cheeks slightly broader than eyes; metatarsi slightly shorter and narrower than their tibiae; abdomen relatively long and narrow, parallel-sided, second to fifth terga quite distinctly grooved basally, and depressed across the apical margins; sixth tergum rounded apically in dorsal aspect, in profile convex to the pronounced shelf-like apical lip; sixth sternum rounded.

Puncturation: Fine and quite close over head, thorax, and basal abdominal segments, becoming slightly more coarse and sparse to the fifth tergum, but fine and dense on the sixth.

Color: Black; antennae beneath and tegulae more fuscous; wings subhyaline basally, pale fuliginous apically and along costal margin, the nervures ferruginous to fuscous; spurs yellowish-ferruginous.

Pubescence: White on face, cheeks, pleura, propodeum and basal abdominal segment; fuscous to blackish on vertex and second to sixth abdominal terga; mesonotum and scutellum with longer erect blackish hairs and shorter white subappressed tomentum, the latter sometimes inconspicuous; clypeus with long outstanding yellowish hairs; second to fifth terga with entire white apical fasciae; scopa pale yellow medially, becoming more whitish basally, black on the sixth sternum and on the fifth apically (often more uniformly white, but usually black at the apex).

*Male.*—Size: Length 12-13 mm.; breadth of abdomen 4 mm.; anterior wing 8.5-9 mm.

Structure: Face slightly longer than broad; eyes slightly convergent below; clypeal margin with a broad shallow median emargination; mandible 3-dentate, inner tooth large, inferior projection triangular, submedian in position, the apex double as seen from beneath, each part with a fringe of very short pubescence; basal joint of flagellum subequal to pedicel, the second joint slightly longer, the apical one somewhat dilated and flattened; lateral ocelli slightly nearer eyes than to edge of vertex; vertex flat; cheeks about equalling eyes in width, with a bare concavity at lower angle, and bare for a short distance above this except for a distinct double row of fine white pubescence, the lower one of long hairs; front coxae flat, bare anteriorly, each with a single robust red spine-like bristle and a long slender spine; front femur flattened, the anterior face polished, with sparse long subappressed seta-like hairs; front tibia short, thickened apically; front tarsi broadly dilated and flattened, the metatarsus anteriorly with an enormous deeply excavated scale, which projects apically beyond the tips of both the second and third joints, each of these being produced apically to some degree, but not at all excavated; mid metatarsus broad and flat, considerably broader than its tibia; hind metatarsi long and slender; abdomen parallel-sided, apical margins of third to fifth terga rather deeply depressed, at least laterally; sixth tergum with a deep pit medially just above the carina, the latter usually with a small median emargination, irregularly crenulate laterally, the emargination often hardly more conspicuous than the crenulations, apical margin of the tergum with very low carinate median teeth, the lateral teeth inevident; seventh tergum triangularly pointed, slightly excavated just above the tip.

Sternites: Lateral portions of fifth presternite longer than broad, apical margin of each rounded or subtriangular, median portion almost linear, the medasternite much broader than long, with only very fine and obscure setae, these toward the basal margin more conspicuous, the poststernal strip with two slender oblique projections which delimit a median incurved area of the apical margin; lateral portion of sixth presternite slightly broader than long, the inner portion of the apical margin of each rolled upward and back, forming a concave area, sharply defined medially and distinctly separated, the medasternal areas much modified, each bilobate laterally, but these two lobes superimposed in part, the more ventral one somewhat rounded laterally, and covered with very minute hairs, the more dorsal lobe acute laterally and fringed apically with long fine flexed setae which are bulbous at the base, the poststernal lobe extensive, rounded apically.

Genital armature: Stipites slender, gradually narrowed above base, obliquely compressed and very slightly dilated apically, tips somewhat bulbous and minutely setose; sagittae about as robust as stipites, the tips abruptly flexed, not quite equalling the stipites in length; volsellae robust, broadly rounded or subtruncate, with a small emargination toward the side of the apical margin.

Puncturation: Fine and close over most of thorax and on cheeks above, more distinctly separated on vertex and scutellum; fine and close on abdomen basally, becoming slightly more coarse but quite close, to the fifth tergum, fine and crowded on the sixth.

Color: Black; antennae beneath reddish-piceous; tegulae ferruginous; wings subhyaline, quite distinctly clouded apically, the nervures ferruginous; front coxae, trochanters and femora largely yellowish; front tibia ferruginous on outer face, suffused with piceous along the margins, the tip yellow, and the other two faces largely yellow; front tarsi ivory, the metatarsal scale lemon-yellow, distinctly tipped with bright ferruginous; second tarsal joint with a black spot beneath; middle legs largely ferruginous; hind legs piceous; spurs yellow.

Pubescence: White on head, thorax, and basal abdominal segment, dense on face and rather dense on thorax laterally and beneath, thinner above, with no visible dark hairs on head or thorax; second to sixth abdominal terga black pubescent; second to fifth terga with entire white apical fasciae; pubescence of legs largely pale; front tarsal fringe white, more golden-brown beneath, the mid tarsi quite densely covered with subappressed pale ochraceous hairs.

*Range.*—Across the southern United States, from Florida to southern California, north to Nebraska in the central part, July in Nebraska, Colorado and Kansas, April to November in Florida. Definite records are as follows:

ARIZONA: 3♂, 1♀, no locality record. 1♂, Florence, Apr. 4, 1903, (C. R. Biederman). 3♂, near Kits Peak, Baboquivari Mts., Aug. 7-9, 1916. 3♂, Pepper Sauce Cn., Santa Catalina Mts., Aug. 15, 1924, (E. P. Van Duzee). Identified also from Santa Rita Mts., Tempe and Tucson.

CALIFORNIA: 1♀, Cushinbury Sp., San Bernardino County, Aug. 19, 1932, (Michener). 1♀, Riverside, July 22, 1927, (Timberlake; on *Senecio douglasii*). Identified also from Jacumba.

FLORIDA: 1♂, 1♀, Jacksonville Beach, Aug. 5, 1936, (Mitchell). 1♂, Miami, June 23, 1924, (S. Graenicher). Identified also from Flamingo and Key Largo.

MEXICO: 2♂, 1♀, Guadalajara, Aug. 10-16, 1903, (McLendon).

NEW MEXICO: 6♀, Alamogordo, May 15 & 29 and June 6, 1902. 1♂, 2♀, Highrolls, June 11 & 12, 1902.

TEXAS: 5♂, 4♀, no locality record. 4♀, Austin, April 5 to May 6. 8♂, 17♀, Bexar County, April 5 to Oct. 10, (Parks). 1♂, 7♀, Bexar County, Sep. 16-19, 1930, (Parks; on *Salvia ballotaeflora*). 1♀, Chisos Mts., July 22, 1911, (H. A. Wenzel). 1♀, Dallas, May 23, 1908, (F. C. Pratt). 1♂, Dallas, May 9, 1906, (F. C. Bishop; on *Amorpha fruticosa*). 1♀, Fedor, Sep. 27, 1897, (Birkmann). 4♀, Galveston, May, (F. H. Snow). 1♂, 1♀, Round Mts. Identified also from Alvin, Brownsville, Devils River, Eastland County, Helotes, Langtry, Lee County, Midland, New Braunfels and Wharton.

Specimens of *pollicaris* have been identified also from the following localities: Kansas—Baldwin and Blue Rapids; Nebraska—Haigler; and Oklahoma—Ardmore.

*Flower records.*—*Brauneria pallida, Senecio douglasii, Verbena* sp., *Amorpha fruticosa* and *Salvia ballotaeflora.*

**Megachile (Sayapis) helianthi** Cockerell

*Megachile helianthi* Cockerell, Ann. Mag. Nat. Hist., (8), I, p. 259, 1908.

No material of this species has been examined personally. It apparently belongs in *Sayapis,* but does not agree with any of the other species, so far as can be judged from the description. The clypeal margin seems to be somewhat similar to that in *pollicaris,* but the following differences can be noted in *pollicaris*: Hind metatarsus slightly longer than the other joints combined; punctures of head and thorax dense and rather fine, and close on clypeus and supraclypeal area; scopa black on sixth sternum and in part on the fifth, the sixth tergum with pubescence entirely black.

The description which follows has been transposed from the original description:

*Female.*—Size: Length 13.5 mm.

Structure: Head large, round; cheeks flattened, not spined; clypeus convex in middle, the lower margin strongly undulate, with a broad central emargination; mandibles short and thick, 4-dentate; first joint of labial palpus slightly shorter than the second; hind basitarsus not quite as long as the other joints together, if claw is included; sixth dorsal segment rapidly descending, strongly concave in profile.

Puncturation: Dense and coarse on head and thorax, on a dullish surface, but clypeus and middle of supraclypeal area shining, with well separated, strong punctures; strong but not dense on abdomen.

Color: Black; antennae dark; tegulae and legs black; wings strongly and broadly infuscated apically, the nervures black.

Pubescence: Greyish-white on head and thorax, but vertex with (intermixed ?) very short dark fuscous hairs; abdomen with narrow white apical fasciae, more or less failing medially, the sixth tergum with sparse erect pale hair basally, and with pale tomentum apically; scopa entirely white.

*Type.*—Female; Boulder, Colorado Aug. 29, 1906, [at *Helianthus lenticularis,* (S. A. Rohwer) ].

*Range.*—Type material from Colorado.

**Megachile (Sayapis) pugnata** Say (Pls. XII and XIII.)

*Megachile pugnatus* Say, Boston Journ. Nat. Hist., IV, p. 408, 1837. Leconte, Compl. Writ. T. Say, II, p. 783, 1859.

*Megachile scrobiculata* Smith, Cat. Hym. Brit. Mus., I, p. 191, 1853. Cockerell, Trans. Am. Ent. Soc., XXXI, p. 337, 1905.

*Megachile bucephala* Smith, Cat. Hym. Brit. Mus., I, p. 193, 1853. Cockerell, Trans. Am. Ent. Soc., XXXI, p. 337, 1905. Friese, Das Tierr., Lfg. 28, Apidae I, p. 235, 1911.

*Megachile disparilis* Cresson, Trans. Am. Ent. Soc., IV, p. 264, 1872. Cresson, Mem. Am. Ent. Soc., I, p. 117, 1916.

*Megachile lucrosa* Cresson, Trans. Am. Ent. Soc., IV, p. 267, 1872. Cresson, Mem. Am. Ent. Soc., I, p. 122, 1916.

*Megachile pugnata* Cresson, Trans. Am. Ent. Soc., VII, p. 120, 1878. Provancher, Nat. Can., XIII, p. 228, 1882. Provancher, Pet. Fauna Ent. Can. p. 712, 1883. Provancher, Add. Corr. Faune Hym. p. 323, 1888. Cockerell, Denison Univ. Bull., XI, p. 65, 1898. Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 8, 1900. Cockerell, Univ. Colo. Stud., IV, No. 4, p. 253, 1907. Cockerell, Univ. Colo. Stud., VII, p. 128, 1910. Friese, Das Tierr., Lfg. 28, Apidae I, p. 244, 1911. Mitchell, Psyche, XXXIII, p. 162, 1926.

*Gnathocera cephalica* Provancher, Nat. Can., XIII, p. 233, 1882. Provancher, Pet. Fauna Ent. Can. p. 716, 1883. Friese, Zeit. Syst. Hym. Dipt., III, p. 248, 1903.

*Ceratias pugnatus* Robertson, Trans. Am. Ent. Soc., XXIX, p. 172, 1903.

*Megachile temporalis* ♀, Friese, Zeit. Syst. Hym. Dipt., III, p. 247, 1903.

*Sayapis pugnata* Titus, Proc. Ent. Soc. Wash., VII, p. 154, 1905.

*Megachile (Sayapis) pugnata* Viereck, Conn. Nat. Hist. Surv. Bull., XXII, p. 742, 1916.

*Female.*—Size: Length 12-18 mm.; breadth of abdomen 3-4.5 mm.; anterior wing 9-11 mm.

Structure: Face considerably broader than long; eyes relatively small, very slightly divergent below; clypeus extremely short, the shining apical margin thickened, about equal in area to the punctate outer face which has a broad median apical lobe and a smaller lateral lobe on each side; mandible large and robust, broadened apically, but without protuberances, with four distinct teeth and a small indistinct one between the two inner teeth; basal joint of flagellum slightly longer than pedicel, about equal to the second joint; lateral ocelli much nearer to each other than to eyes, and much nearer eyes than to edge of vertex; vertex broad behind eyes, nearly flat, the hind margin deeply incurved; cheeks slightly broader than eyes, broader below, posterior margin definitely carinate, and terminated by a robust protuberance below, the inferior surface between this protuberance and the base of the mandible polished and impunctate; metatarsi slightly shorter and narrower than their tibiae; abdomen long and narrow, parallel-sided, basal grooves and apical depressions of second to fifth terga distinct but not extreme; sixth tergum somewhat rounded in dorsal aspect, in profile concave just before the tip, the sixth sternum more triangular, the tip with a triangular emargination.

Puncturation: Fine and close on face, clypeus, vertex and pleura; very coarse and sparse on cheeks, and rather much so on supraclypeal area; fine and quite close on dorsum of thorax, but the shining surface evident between the punctures medially; fine and close over entire abdomen, more so basally.

Color: Black; antennae slightly more fuscous beneath; tegulae reddish-fuscous; wings transparent fuliginous, the nervures fuscous to black; spurs yellowish.

Pubescence: White on face, cheeks below, pleura, propodeum, and basal abdominal segment; black and rather long and sparing on vertex and dorsum of thorax, shorter and more dense on second to sixth abdominal terga; second to fifth terga with entire white apical fasciae; scopa pale yellowish, fuscous or black on the sixth sternum.

*Male.*—Size: Length 11-13 mm.; breadth of abdomen 3-3.5 mm.; anterior wing 7-9 mm.

Structure: Face about as broad above as long; eyes slightly convergent below; clypeal margin nearly straight, with a slight protuberance on each side of middle; mandible rather narrow. 3-dentate, the triangular inferior projection submedian in position; basal joint of flagellum slightly longer than pedicel, slightly shorter than the second joint, the apical one very slightly dilated and flattened; lateral ocelli slightly nearer eyes than to edge of vertex; vertex nearly flat; cheeks broader than eyes, lower angle with a large bare concavity which has the lower margin produced into a spine-like projection; front coxae bare anteriorly, with three or four robust spine-like bristles in front of the long slender spines; front femora rather slender; front tarsi broadly dilated and flattened, the metatarsus produced anteriorly into an extremely large hollow scale which is produced apically fully to the tip of the second joint, the third joint slightly shorter than the metatarsus, the second shorter than the third; abdomen parallel-sided, apical margins of the terga only slightly depressed; carina of sixth tergum with a small rounded median emargination, the apical margin of the tergum with carinate median teeth which are nearer the lateral angles than to each other, the lateral teeth absent; seventh tergum variable, usually somewhat pointed, and with a concavity just back of the pointed apex.

Sternites: Lateral portions of fifth presternite very narrow, the plate occupied in large part by the extensive medasternite which bears numerous curved but simple setae, these becoming very fine and inconspicuous toward the center apically, the poststernal strip broadly incurved on each side of middle; lateral portions of sixth presternite longer than broad, the medasternal areas much modified and rather extensive, well separated medially, each with a lateral acute lobe which bears closely set robust setae, and an apical flattened lobe which bears an apical fringe of four or five robust curved setae, the remainder of each area covered with fine simple setae, the poststernal lobe extensive, broad and relatively short, rounded rather than angulate.

Genital armature: Stipites much narrowed above base, gradually dilated and obliquely compressed to the rounded tips, the inner surface of each covered in part with short and fine hairs; sagittae lobate at base dorsally, slightly narrowed to the rather abruptly flexed tips; volsellae small, triangularly rounded.

Puncturation: Fine and close over entire head, as also on pleura and on mesonotum anteriorly; quite close but more distinctly separated on mesonotum medially and on scutellum; minute but well separated on abdomen basally, becoming deeper but fine and close on the more apical terga, very fine and close on the sixth.

Color: Black; antennae, tegulae and legs more or less piceous, the tarsi more or less reddish; front tarsi yellowish to ivory, second joint with a small dark spot beneath, and two parallel ferruginous lines extending along posterior margin of the joints beneath; wings subhyaline, quite distinctly clouded apically, the nervures yellowish to ferruginous, or nearly piceous; spurs yellow.

Pubescence: Rather pale ochraceous above, fading to white below, very dense on face and clypeus, with intermixed fuscous hairs on vertex and mesonotum; blackish or fuscous on second to sixth abdominal terga; second to fifth terga with entire whitish apical fasciae, and the fourth with a narrow basal fascia; legs pale pubescent, front tarsal fringe whitish above, brownish beneath, the metatarsal scale with a dense fringe of short black pubescence on the basal third of the inner anterior margin.

*Range.*—Across the entire United States and southern Canada, but with no records from the southeast between Florida and Texas, apparently ranging southward only at the higher altitudes. The flight period is from June to September. Definite records are as follows:

ALBERTA: 2♂, 6♀, Beaverlodge, June 25 to Aug. 9, 1931, (O. Peck). 1♀, Calgary, July 25, 1926, (G. Salt). 1♂, Wabamun, June 28, 1936, (Strickland). Identified also from Bilby, Cooking, Edmonton, High River, Lethbridge, Slave Lake.

CALIFORNIA: 1♂, Huntington Lake, July 7, 1919, (F. E. Blaisdell). 1♂, 1♀, Lake Tahoe, Aug. 22, 1916, (L. Bruner). 1♀, Monanche Mdw., Tulare County, July 26, 1935, (Evans). Identified also from Meadow Valley, Plumas County, Phillips County, Placer County and Truckee.

COLORADO: 5♂, 2♀, no locality record. 1♂, Boulder, May 26, 1908, (S. A. Rohwer; on *Besseya plantaginea*). 1♂, Boulder, Aug. 14, 1935, (Michener). 8♂, 16♀, Boulder County, June 9 to Aug. 8, 1925, (Custor and Hicks). 1♂, Estes Park, June, 1916, (Cockerell). 2♂, 1♀, Leadville, Aug. 3-5, 1919. 1♂, Manitou, July 21, 1897, (on *Cleome*). 1♂, Silver Plume, July 10, 1897, (on *Senecio*). 1♂, Tennessee Pass, July 30 to Aug. 2, 1919. 1♂, 1♀, Ute Creek, 9000 ft., July 24 and Aug. 9, (R. W. Dawson and L. Bruner). 1♂, Ward. 1♂, Ward, Aug. 10, (W. P. Cockerell). Identified also from Aspen, Bear Creek, Chimney Gulch, Colorado Springs, Creede, Florissant, Fort Garland, Pikes Peak, Platte Canyon, and Tolland.

ILLINOIS: 1♂, 1♀, no locality record. 1♀, Palos, Aug. 13, 1932, (J. Pearson). Identified also from Algonquin and McHenry.

MASSACHUSETTS: 1♂, 1♀, Forest Hills, July 9 and 12, 1926, (Mitchell; ♂ on *Rudbeckia hirta*, ♀ on *Asclepias*). Identified also from Groton.

MICHIGAN: 1♀, Cheboygan County, Aug. 14, 1931 (Strickland). 1♀, Fiber, July 25, 1932, (H. Pearson). Identified also from Grand Rapids.

NEBRASKA: 1♀, Monroe Canyon, Sioux County, Aug. 7, 1908, (C. H. Gable). 1♂, Sioux County. 1♀, War Bonnet Canyon, Sioux County, July 23, 1901, (M. A. Carriker, Jr., on *Verbena*). Identified also from Louisville and Pine Ridge.

NEVADA: 1♂, no locality record.

NEW MEXICO: 1♀, Beulah, June 29, 1902. 1♀, Rociada, Aug. 8, (Cockerell).

NORTH CAROLINA: 1♂, 2♀, Busick, July 26, 1936, (on *Mint*). 2♂, 1♀, Cruse, June 24-28, 1934, (on *Trifolium repens* and *Chrysanthemum leucanthemum*). 3♂, 1♀, Mars Hill, July 6, 1928. 1♀, Swannanoa, Sept. 5, 1924, (on *Vernonia*); (all Mitchell).

OHIO: 1♀, Wauseon, Aug. 5, 1896. Identified also from Smithfield and Put-in-Bay.

OREGON: 2♂, 1♀, Crater Lake Park, Pole Bridge Meadow, 5900 ft., Aug. 11, 1935, (Scullen and Ferguson). 1♀, Diamond Lake, 5182 ft Aug. 16, 1935 (Scullen). 1♀, three miles south of Lava Lake, Deschutes County, 4700 ft., Aug. 9, 1935, (Scullen). 1♂, Sparkes Lake, Deschutes County, 5428 ft., Aug. 8, 1935, (Scullen). 3♂, Three Sisters, Campers Lake, 4700 ft., and Wh. Br. Cr., 5400 ft., Aug. 11 and 15, 1926, (H. A. Scullen; on *Aster*). 5♀, Three Sisters, Scott Lake, 4650 ft., Aug. 8 and 10, 1926 (H. A. Scullen; on *Aster*). Identified also from Alsea, Corvallis, Forest Grove and Sherwood.

PENNSYLVANIA: 1♀, Philadelphia, Aug. 7, 1932, (J. Pearson).

QUEBEC: 1♂, Montreal. Identified also from Montfort, Ottawa and Terrebonne.

TEXAS: 1♂, no locality record, (Belfrage).

UTAH: 1♀, Bryce Canyon, Aug. 10, 1931, (J. Wilson; on *Thistle*).

VIRGINIA: 1♂, 2♀, no locality record.

WASHINGTON: 1♀, no locality record. Identified from Orcus Island and Yakima City.

WEST VIRGINIA: 1♀, Fairmont, July 21, 1907.

Specimens of *pugnata* have been identified from the following additional localities:

Arizona—Humphrey's Peak and Oak Creek Canyon; British Columbia—Kaslo and Vernon; Connecticut—Colebrook; District of Columbia; Idaho—Bear Lake and Troy; Iowa; Kansas—Blue Rapids; Minnesota; Montana—Bozeman and Helena; New York—Ithaca and Orient; North Dakota—Fargo, Kuhn and Mott; Ontario—Bobcaygeon; South Dakato—Custer; Utah—Huntsville and Salt Lake; Vermont—Rutland; Wisconsin—Oconto Falls; and Wyoming—Bridge Basin, Cheyenne and Laramie River.

*Flower records.*—*Arctium minus, Aster, Brauneria pallida, Carduus plattinus, C. undulatus, Erigeron, Helianthus tuberosus, Melilotus, Rudbeckia hirta, R. occidentalis, Taraxacum officinale, Verbena* and *Vernonia.*

**Megachile (Sayapis) pugnata** var. **pomonae** Cockerell

*Megachile pugnata* var. *pomonae* Cockerell, Ann. Mag. Nat. Hist., (8), XVII, p. 278, 1916.

*Female.*—Similar to the typical form structurally, differing chiefly in the more ochraceous pubescence, with the black pubescence reduced or inconspicuous, and with conspicuous ochraceous tomentum on the sixth tergum.

*Type.*—Female; Mts. near Claremont, California, (Baker), [Cockerell].

*Range.*—Western, from California to Colorado. Definite records are as follows:

CALIFORNIA: 1♂, 1♀, no locality record. 1♀, Agnew Mdws, Modera Co., July 30, 1936, (G. E. Bohart). 2♂, 2♀, Alta Meadow, 9000 ft., Aug. 23, 1917, (Wheeler). 1♀, Huntington Lake, July 25, 1919, 7000 ft., (E. P. Van Duzee). 1♂, 3♀, Inyo Co., 9700 ft., July 7 and 14, 1934, (G. E. Bohart). 1♂, 1♀, Mammoth, July 25, and 27, 1933, (G. E. and R. M. Bohart). 1♀, Meadow Valley, Plumas County, 5000-6000 ft., June 21, 1924, (E. C. Van. Dyke). 1♂, Mineral King, Aug. 11, 1935, (G. E. Bohart). 2♂, Mono Co., 9700 and 10,700 ft., July 16 and 25, 1934, (G. E. Bohart). 1♂, 1♀, San Gabriel Canyon, Los Angeles County, June 25, 1933, (Michener; ♂ on *Dicentra chrysantha,* ♀ on yellow *Cruciferae*). 1♀, Tioga Pass, July 27, 1930, (G. E. and R. M. Bohart). 1♀, Trinity Co., June 13, 1934, (G. E. Bohart).

COLORADO: 7♀, no locality record. 2♀, Boulder County, June 18 and July 26, 1925, (C. P. Custer). 1♀, Denver, July 11, 1897. 3♀, Leadville, Aug. 3-5, 1919. 1♀, Tennessee Pass, Aug. 6-8, 1920.

NEVADA: 19♀, no locality record.

NEW MEXICO: 1♀, Beulah, June 30, 1902.

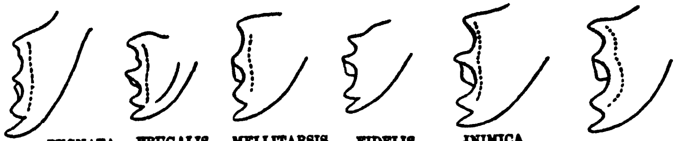
## EXPLANATION OF PLATES

### PLATE XII

Outlines of clypeus, mandible and head in females and of front tarsus and apex of abdomen in males of *Sayapis*.

### PLATE XIII

Outlines of fifth, sixth and eighth sternum and of genital armature in males of *Sayapis*.



PUGNATA

FRUGALIS

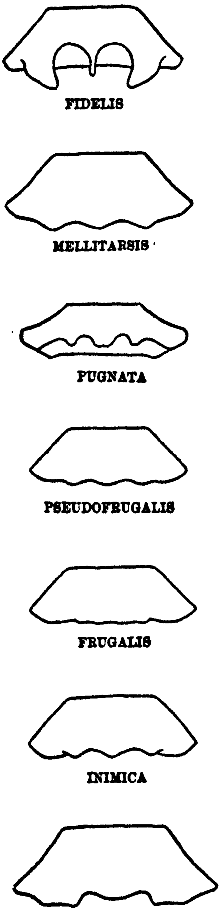
MELLITARSIS

FIDELIS

INIMICA

POLLICARIS

FEMALE MANDIBLE



FIDELIS

MELLITARSIS

PUGNATA

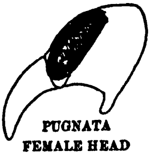
PSEUDOFRUGALIS

FRUGALIS

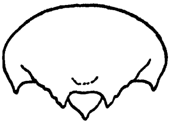
INIMICA

POLLICARIS

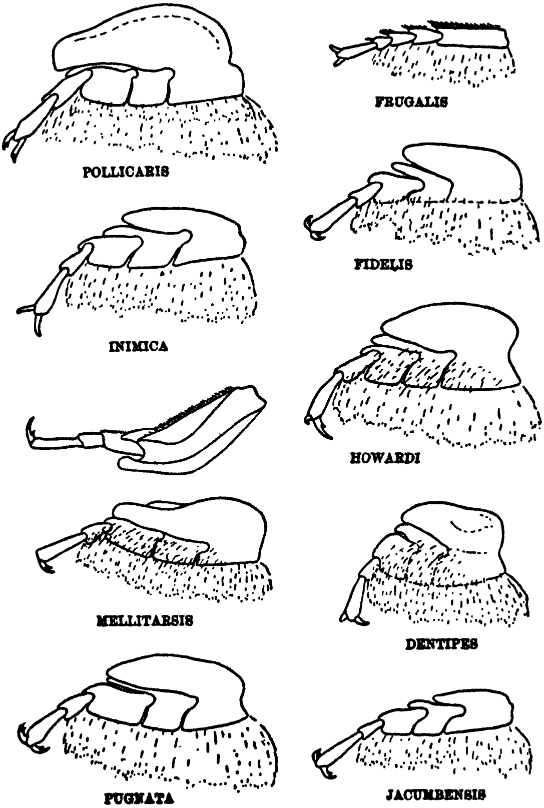
FEMALE CLYPEUS



PUGNATA
FEMALE HEAD



FRUGALIS
APEX OF MALE ABDOMEN



POLLICARIS

INIMICA

MELLITARSIS

PUGNATA

FRUGALIS

FIDELIS

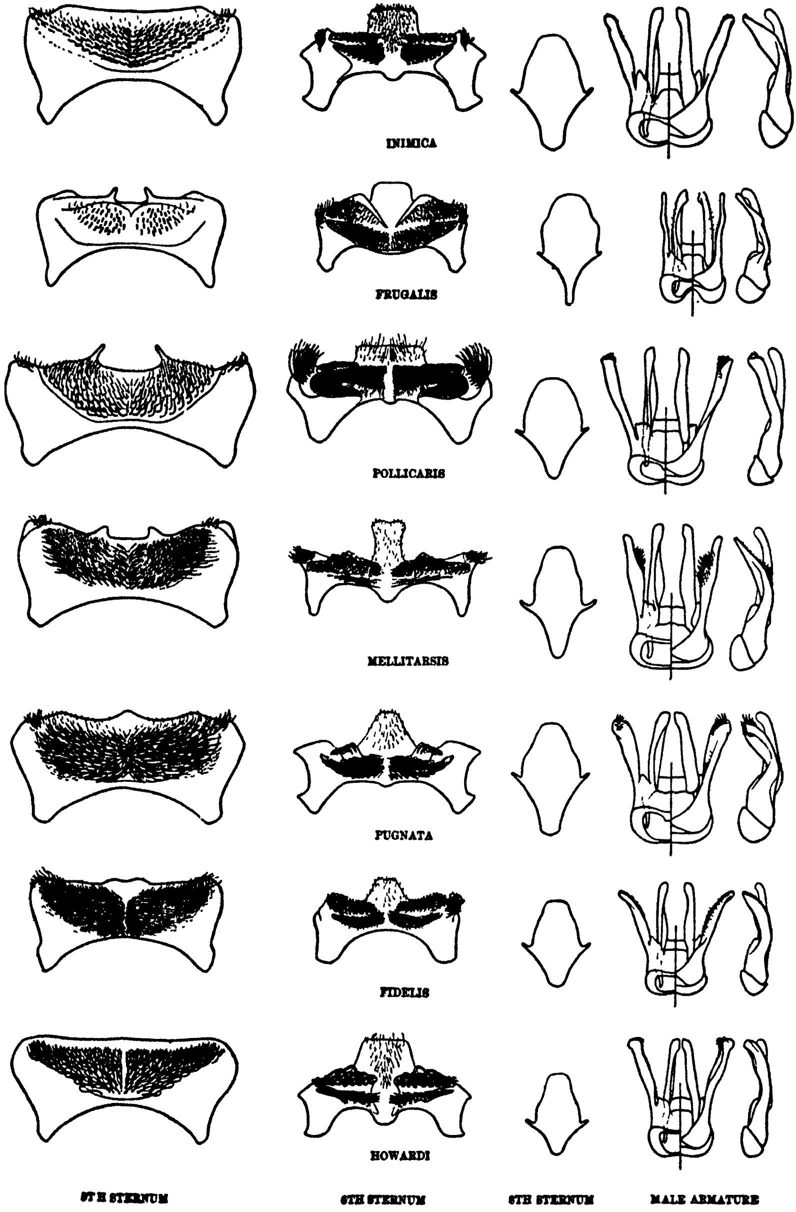
HOWARDI

DENTIPES

JACUMBENSIS

MALE FRONT TARSUS

MITCHELL—NEARCTIC MEGACHILE



MITCHELL—NEARCTIC MEGACHILE

# NEW OR LITTLE KNOWN NEOTROPICAL BLATTIDAE

## (ORTHOPTERA)

## NUMBER FOUR

BY JAMES A. G. REHN

(Plates XIV to XVII)

The introductory remarks for this series will be found in Number One of the contributions.[1]

The present number contains a revision of the genus *Cahita* Hebard, made necessary by the determination of a species for use in another connection and possible by other series placed in my hands for study, and the description of four new genera and eleven new species, the recognition of which has been due to extensive representations loaned for study or acquired through expeditions or purchase by the Academy of Natural Sciences of Philadelphia, or the Hebard Collection which is there located.

The species discussed in the present number are: (Pseudomopinae) *Cahita misella* new species, Tobago, *C. nahua* (Saussure), eastern Mexico to Costa Rica, *C. yaqui* new species, Sinaloa, Mexico, *C. nigripes* Hebard, Panama, *C. insignis* (Hebard), French Guiana, *C. hystrix* new species, Amazonas, Brazil, *C. borero* new species, southern Brazil and northern Argentina, *C. linguata* new species, Matto Grosso, Brazil; (Blattinae) *Eurycotis histrio* new species, Haiti; (Epilamprinae) *Dryadoblatta mira* new species, Venezuela; (Panchlorinae) *Phortioecoides guarani* new genus and species, Paraguay and southern Brazil: (Blaberinae)

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[1] Trans. Amer. Entom. Soc., LIV, p. 125, (1928). Number Two appeared in the same serial, LVI, pp. 19-71, (1930) and Number Three in volume LVIII, pp. 103-137, (1932).

*Hiereoblatta* new genus for *H. cassidea* (Eschscholtz), southern Brazil; (Corydiinae) *Latindia pectinata* new species, southern Brazil, *Ceuthobia fratercula* new species, Paraguay; (Perisphaerinae) *Sibylloblatta* new genus for *S. panesthoides* (Walker), Jamaica, and *Bion mastrucatus* new genus and species, southern Brazil.

## PSEUDOMOPINAE

### THE SPECIES OF THE GENUS CAHITA

The genus *Cahita* was erected by Hebard in 1923, based on Saussure's *Ischnoptera nahua,* described in 1868 from Mexico. At the time the genus was erected material from the Mexican states of Sinaloa, Morelos and Vera Cruz was referred to *nahua.* In 1933 the same author referred a new Panamanian species (*C. nigripes*) to *Cahita.* In the intervening years he erected a genus *Galibia* on a new species (*C. insignis*) from French Guiana. At the time of its description, no comparison of *Galibia* was made with *Cahita.* This brief summary gives the full historical picture of the subject of this study as far as past literature is concerned.

The recent necessity for determining certain Neotropical material which was found to belong to *Cahita* compelled a full examination of the situation, this including all the available specimens belonging to the genus, and other allied genera, these embracing all the typical and other material examined at various times by Hebard. These specimens are very largely contained in the Philadelphia collections.

As a result of this revision I find the genotype of *Galibia* is not generically distinct from that of *Cahita, nahua* and *insignis* representing instead distinct and well marked species of the same genus. Aside from all other general similarities, these species both have very short, subtrigonal penultimate and much enlarged ultimate palpal articles, very weakly oblique discoidal sectors of the tegmina, the alar discoidal vein undivided, the abdomen of the male with only the median segment (proximal tergites) specialized, but two large distal spines on the ventrocephalic margin of the cephalic femora, the arolia large and the tarsal claws strongly asymmetrical, the male also with the ultimate tergite (supra-anal plate) trigonal and the ultimate sternite (subgenital plate) in the same sex with fully developed similar styles and the margin between variously developed.

In addition to establishing this synonymy and relationship, I also ascertained that *C. nahua* as understood by Hebard in 1923 is composite, one element representing true *nahua*, the other a distinct and undescribed species. Further the series now before me contains four additional undescribed species, and all five new forms are here characterized.

## CAHITA Hebard

1923. *Cahita* Hebard, Trans. Amer. Entom. Soc., xlvii, p. 167.
1926. *Galibia* Hebard, Proc. Acad. Nat. Sci. Phila., lxxviii, p. 185. [Based on *Galibia insignis* Hebard.]

Genotype (by original designation): *Cahita nahua* (Saussure) [*Ischnoptera nahua* Saussure, 1868].

The generic description given by Hebard in 1923 presents the salient features of the genus, and in the light of the six species of the same now known, instead of solely the genotypic one, fortunately requires but little modification. The chief amplification would be that the proximal group of large spines on the ventro-cephalic margin of the cephalic femora may be composed of as many as five, or it may be entirely lacking.

Among the American genera of the subfamily, *Cahita* is distinctive in possessing a combination of longitudinal tegminal discoidal sectors, complete and incomplete alar ulnar rami, disproportionately inflated ultimate and penultimate palpal articles, asymmetrical tarsal claws, large arolia, but two distal large spines on ventro-cephalic margin of cephalic femora and the specialization of the dorsum of male abdomen limited to the proximal tergite (median segment).

The proper position of the genus is uncertain. In many ways it suggests the African genus *Euandroblatta* Rehn,[2] but lacks the truly symplocoid femoral marginal spination found in the latter genus. Until our knowledge of the natural groups of the present subfamily is more comprehensive, it is probably best to allow *Cahita* to remain in the general neighborhood of *Ischnoptera*, from which, however, it is separable by palpal, distal cephalic femoral spination, tarsal and male abdominal specialization features.

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[2] A study of this genus has recently been presented by the author. Proc. Acad. Nat. Sci., Phila., lxxxix, pp. 22-50, (1937).

*Distribution.*—Our present information shows that the genus *Cahita* ranges from the states of Sinaloa, Morelos and Vera Cruz, Mexico southward to southern Brazil, eastern Peru, and extreme northern Argentina, occurring also in Tobago, but it is not known from Andean South America. Within this great area of its occurrence it is probably localized, or at least it may not be found in certain districts. It is certain, however, that the sections in which the genus is known to occur embrace a wide type of environmental conditions, ranging from lowland rain forest to grassy savannas and plains and semi-arid regions.

### *Key to Species (based on males)*

1. Ultimate sternite (subgenital plate) with distal margin divided mesad into two short, bulbous lobations of specialized character ...........7
   Ultimate sternite (subgenital plate) with distal margin undivided mesad ..........................................................2
2. Ultimate sternite (subgenital plate) with transverse brush of bristles on median (interstylar) portion of the distal margin, this area not triangularly produced ..............................................3
   Ultimate sternite (subgenital plate) without a transverse brush of bristles, the interstylar portion of the distal section of same triangularly produced, and provided on ventral surface with a low, medio-longitudinal ridge bearing brief, recurved, claw-like teeth ..........6
3. Bristle series of ultimate sternite (subgenital plate) longer, nearly equal in transverse extent to distance between styles. Median portion of inter-stylar margin of same tergite subtruncate ....................4
   Bristle series of ultimate sternite (subgenital plate) shorter, equal to no more than half distance between styles. Median portion of interstylar margin of same tergite arcuate ..............................5
4. Size larger. Cephalic femora with proximal group of 3 to 4 larger spines on ventro- cephalic margin. Head and tarsi not at all blackish fuscous ..........................................*yaqui* new species
   Size smaller. Cephalic femora with at most but one larger spine proximad on ventro-cephalic margin. Head almost entirely, and tarsi largely blackish fuscous ...........................*nigripes* Hebard
5. Size larger (length of tegmen of male, 11.2-11.4 mm.). Interstylar portion of distal margin of ultimate sternite (subgenital plate) less

produced, not as strongly arcuate. Ultimate tergite (supra-anal plate) less sharply acute-angulate at apex. Limbs, (particularly median and caudal tibiae) longer, more slender ................*nahua* (Saussure)

Size smaller (length of tegmen of male, 10.5 mm.). Interstylar portion of distal margin of ultimate sternite (subgenital plate) more strongly produced arcuate. Ultimate tergite (supra-anal plate) more sharply acute-angulate at apex ..........................*misella* new species

6. Ultimate tergite (supra-anal plate) triangularly produced, median length of production equal to two-thirds proximal width of same. Limbs shorter and more robust ..........................*borero* new species

Ultimate tergite (supra-anal plate) elongate mesad, acute linguiform produced, median length of production subequal to proximal width of same. Limbs more slender and elongate. (Dorsum of abdomen medio-longitudinally marked with fuscous.) .....*linguata* new species

7. Size smaller (length of tegmen of male, 12.8 mm.). Tegmina more slender, acute lanceolate, anal field narrower and relatively more elongate. Ultimate tergite (supra-anal plate) brief sublinguiform, apex narrowly rounded. Ultimate sternite (subgenital plate) with paired median processes each provided with a brush of recurved spiniform chaetae ......................................*insignis* (Hebard)

Size larger (length of tegmen of male, 14.6 mm.). Tegmina broader, blunter lanceolate, anal field broader and relatively shorter. Ultimate tergite (supra-anal plate) rather broad, apex emarginato-bilobate. Ultimate sternite (subgenital plate) with paired median processes, each with four or more spiniform teeth ..............*hystrix* new species

The females of the species of the genus are very difficult to distinguish, and their features are so relative it is not feasible to present them graphically in a key.

### *Arrangement of Species*

A phylogenetic arrangement of the species of the genus which will express affinities is not difficult, but to place them in a linear fashion and maintain full relative values cannot be done. In consequence a compromise linear arrangement, which brings together in that order almost all of the more nearly related forms, appears the most logical method of procedure.

Phylogenetically, I would arrange the species now known in three groups, i.e. the Nahua Group (comprising *nahua, misella, yaqui* and *nigripes*, the Insignis Group (*insignis* and *hystrix*) and the Borero Group (*borero* and *linguata*). I consider *nahua* to be the most generalized member of the genus, and *yaqui* the most specialized and divergent member of the Nahua Group, with *nigripes* showing a clear tendency toward the Insignis Group. The Borero Group has split off at an undetermined point, but probably well back in the evolution of the genus.

The sequence of the species which follows is my understanding of the simplest and most logical presentation possible in a linear arrangement.

**Cahita nahua** (Saussure) (Pl. XIV, figs. 1-3.)

1868. *Ischnoptera nahua* Saussure, Rev. et Mag. de Zool., 2e ser., xx, p. 356. [♂, ♀; Mexico.]

1870. *Ischnoptera nahua* Saussure, Miss. Scient. du Mex., Rech. Zool., vi, p. 56, pl. 2, fig. 33. [♂, ♀; Orizaba, Mexico.]

1923. *Cahita nahua* Hebard, Trans. Amer. Entom. Soc., xlviii, p. 169, footnote 16. (Footnote only and in part.) [♂; Motzorongo, V. C., and Vera Cruz, V. C., Mexico.]

State of Vera Cruz, Mexico: Motzorongo; February, 1892; (L. Bruner); 2 ♂; [Hebard Cln.]. Vera Cruz; (Heyde); 1 immature ♂; [Hebard Cln.].

Honduras: Cantarranas, Rio Choluteca, elevation 2200 feet; July 19 to 20 and August 5 to 9, 1930; (Honduras Expedition, J. A. G. Rehn; all beaten from foliage along roads or in thickets); 2 ♂, 5 ♀; [A. N. S. P.]. Rosario, San Juancito Mts., elevation, 5150 feet; August 13, 1930; (Honduras Expedition, J. A. G. Rehn); one immature ♂; [A.N.S.P.].

Costa Rica: San Antonio de Nicoya, elevation, 50 meters; July 29, 1929; (M. Valerio); 1 ♀; [A.N.S.P.].

As far as can possibly be determined without actual comparison with Saussure's type, presumably in the Geneva Museum, this species represents true *nahua*. The details of the ultimate sternite of the male have been diagnosed in the key to species, and the accompanying figure will aid further in the recognition of Saussure's species.

There is an appreciable amount of size variation, which is apparently individual in character. The following measurements (in millimeters), supplementary to those already given for the Motzorongo males by Hebard,[8] show the extent to which this is evident in the present series.

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[8] Vide supra.

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| ♂, Cantarranas, Honduras ..... | 12 | 3.27 | 4.78 | 14.2 | 4.45 |
| ♂, Cantarranas, Honduras ..... | 12.7 | 3.19 | 4.45 | 13.4 | 4.28 |
| ♂, Cantarranas, Honduras ..... | 12.5 | 3.19 | 4.45 | 11.2 | 3.86 |
| ♀, Cantarranas, Honduras ..... | 14.3 | 3.36 | 4.78 | 13.4 | 4.36 |
| ♀, San Antonio de Nicoya, Costa Rica ............. | 11 | 3.27 | 4.53 | 12.5 | 3.69 |

It will be seen from the records given above, the range of this species extends from central Vera Cruz in eastern Mexico southward, apparently switching to the semi-arid west coast of Central America, across western Honduras (Cantarranas and Rosario) to the Nicoya Peninsula section of western Costa Rica (San Antonio de Nicoya). While this area, at least as far as the west coast is concerned, is one with a very pronounced dry season, all of the material listed above from the district was taken during the rains.

**Cahita misella** new species (Pl. XIV, fig. 4.)

Closely related to *C. nahua* (Saussure), of which it appears in general to be a smaller replica, but differs in the male sex in the more definitely trigonal and more acutely angulate ultimate tergite (supra-anal plate), in the ultimate sternite (subgenital plate) of the same sex having the interstylar portion of the distal margin more strongly arcuate produced, in its limbs being somewhat shorter and less slender, particularly the median and caudal tibiae, and its inferior size.

From *P. nigripes* Hebard, which is nearly the same size, *misella* differs in lacking any black coloration on the head, in possessing four proximal spines on the ventro-cephalic margin of the cephalic femora, and in having the interstylar portion of the distal margin of the ultimate sternite of the male strongly arcuate produced. The smaller size as well as femoral spination and genital features set forth in the key will readily separate *misella* from *yaqui*.

*Type.* — ♂ ; Archibald Estate, Roxborough, Tobago, British West Indies. November 6, 1918. (Harold Morrison.) [United States National Museum].

Size quite small, the most diminutive member of the genus; form and surface essentially as in *nahua*.

Head as in *C. nahua*.

Pronotum in proportions and outline as in *nahua*, greatest length being contained one and one-third times in greatest width; principal lateral angles slightly more rounded than in *nahua*.

Tegmina elongate lanceolate, as in *C. nahua*, greatest width contained slightly more than three times in greatest length, apex narrowly rounded; costal margin arcuate proximad and distad, straight mesad, sutural margin straight, in distal two-fifths evenly rounded to apex: relative size and shape of fields and venation disposition as in *C. nahua*.

Ultimate tergite (supra-anal plate) moderately produced, trigonal, lateral margins obliquely straight convergent, apex very narrowly rounded. Ultimate sternite (subgenital plate) broad, relatively flat, in transverse section but slightly arcuate, portions of margin laterad of styles convergent to the bases of the latter, slightly arcuate; interstylar portion of margin strongly arcuate produced, its median length equal to one-half width of same area on a line between stylar bases, this width equal to approximately half of greatest proximal width of sternite, the interstylar production reflexed into a vertical position,[4] its margin with the median half regularly supplied with radiating, slightly arcuate chaetae; styles simple, straight, in length equal to approximately one-third the distance between their bases.

Limbs relatively robust, stockier than in *C. nahua*: cephalic femora with proximal spine group on ventro-cephalic margin numbering four, of which the more proximal is slightly removed from the other three.

General coloration throughout subtranslucent ochraceous-buff, the lateral areas of the pronotum and the marginal fields of the tegmina almost clear hyaline. Interocellar areas of head nebulously washed with ochraceous-orange, eyes mummy brown; abdomen ventrad and its appendages approaching clay color.

Length of body, 11 mm.; length of pronotum, 2.68; greatest width of pronotum, 3.61; length of tegmen, 10.5; greatest width of tegmen, 3.19.

The type of this diminutive species is unique. Clearly a member of the Nahua Group, *misella* indicates that the group ranges eastward across extreme northern South America, and adds further evidence of the close mainland and non-Antillean affinity of Tobagan forms.

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[4] I am not certain this reflexing is a normal condition, or whether it is due to the pull of drying chitin.

**Cahita yaqui** [5] new species

1923. *Cahita nahua* Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 169, pl. 6, figs. 10 to 12. (In part.) [♂; Venvidio, Sinaloa, and Cuernavaca, Morelos, Mexico only.]

Hebard confused this species with true *nahua*, which he had before him from several Vera Cruz localities. The recent acquisition of Honduras material of *nahua* has supplied a more extensive series for examination, and permitted a correct valuation of the differences seen and noted by Hebard, but which he felt were purely individual. We now know this is incorrect, and that two quite distinct species are involved, the chief differential features of which are given in the key to the forms.

*Type.*—♂; Venvidio, State of Sinaloa, Mexico. September 2, 1918. (J. A. Kusche). [Hebard Collection, Type no. 1290].

The features presented in the following description are supplementary to those already given by Hebard from the same specimen.[6]

Size medium; form as in *C. nahua.*

Head of pronotum as in *C. nahua.*

Tegmina surpassing apex of abdomen by a distance equal to two-thirds of the pronotal length, their general form as in *C. nahua*, greatest width contained one and one-third times in greatest length of same, discoidal rami nine in number. Wings with costal veins and similar rami from the discoidal vein fifteen to seventeen [7] in number, simple; medio-discoidal interspace subequal in width to the medio-ulnar, both relatively narrow; ulnar vein with four complete and three incomplete rami.[8]

Proximal tergite with glandular specialization as in *C. nahua.* Ultimate tergite (supra-anal plate) trigonal, its greatest proximal width equal to one and three-fourth times the greatest median length of the same, converging lateral margins straight oblique, apex rather broady rounded:[9] cerci as long as median length of ultimate tergite, composed of eleven articles, tapering in distal three-fifths: ultimate sternite (subgenital plate) with interstylar production of distal margin very broad, distinctly wider than in *C. nahua* or *misella*,[10] this area arcuato-truncate and supplied for its full width with a regular and uniform series of closely placed chaetae, the whole interstylar section regularly and (in section) arcuately reflexed dorsad; styles simple, short, slightly tapering in distal half.

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[5] After the well-known Yaqui people of southern Sonora.

[6] In describing the ultimate palpal article Hebard uses the word "distal surface" for ventral surface and "dorsal margin" for internal margin.

[7] Latter in Cuernavaca male.

[8] In the Cuernavaca male one of the complete ulnar rami itself sends two complete rami to the margin, and four incomplete rami are present.

[9] Hebard's figure of this tergite (pl. 6, fig. 10) shows the apex distinctly too broad and the lateral margins not quite straight enough.

Cephalic femora with ventro-cephalic margin bearing four large proximal spines, succeeded by a much shorter, rather sparse, subchaetiform series and finally the distal pair of strong, unequally long spines; ventro-caudal margin with three to four long well-spaced spines. Caudal tarsi with proximal article slightly longer than the remaining articles combined.

General color uniform ochraceous-buff, slightly darkened to pale zinc orange on both the dorsal and ventral surfaces of the abdomen. Limbs faintly more rufescent than general color, but not as much so as abdomen. Eyes cinnamon-brown marked with mummy brown.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| ♂, Venvidio, Sinaloa, *type* ..... | 15 | 3.61 | 5.37 | 14.8 | 4.45 |
| ♂, Cuernavaca, Morelos, *paratype* [11] ............. | 14 | 3.27 | 4.7 | 14.5 | 4.28 |

In addition to the type I have before me the male individual from Cuernavaca, Morelos, Mexico (November, 1905; (W. Schaus); [U.S.N.M.]) which Hebard reported in 1923 as *nahua* (vide supra). This specimen represents the new *yaqui*, and I am considering it a paratype.

From the information now available it is evident that *yaqui* ranges over a considerable portion of western and south-central Mexico from Sinaloa to Morelos, apparently there replacing the complementary *C. nahua* of the eastern slopes of the Cordillera Oriental, which latter species crosses to the western coast of Central America, presumably at the Isthmus of Tehuantepec. Apparently *yaqui* does not extend south of the latter district, and the real delimiting factor may be the excessively hot and arid valley of the Rio Balsas.

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[10] This has been well figured by Hebard, plate 6, fig. 12.

[11] These measurements differ somewhat from those given by Hebard for the same specimens. The present ones have been most carefully checked, and the smaller ones all made with the aid of calibrated gratings.

**Cahita nigripes** Hebard

1933. *Cahita nigripes* Hebard, Trans. Amer. Entom Soc., LIX, p. 116, pl. 6, fig. 6. [♂; Changuinola District, Boca del Toro, Panama.]

The unique type of this species is now before me. I have no remarks to add to the original description except that it is clearly a close relative of *nahua, misella* and *yaqui*, which I would place at the end of the Nahua Group. My reasons for so doing are chiefly the weak median emargination of the otherwise arcuate margin of the interstylar portion of the ultimate sternite (subgenital plate), and the very distinctive solidly black head, which color involves the proximal antennal article but not the palpi or ocellar spots, which are ochraceous (palpi) or buff-pink (ocellar spots), or the eyes, which are mummy brown bordered with cinnamon-brown.

The ventro-cephalic margin of the cephalic femora is unarmed proximad or has a single short spine. It will be interesting to learn what a series of the species will show in the way of spine constancy at this point.

**Cahita insignis** (Hebard)

1926. *Galibia insignis* Hebard, Proc. Acad. Nat. Sci. Phila., LXXVIII, p. 186, pl. 15, figs. 11–13. [♂; St. Jean du Maroni, French Guiana.]

The synonymy of the genus *Galibia* has been discussed on a preceding page. No material other than the type is known of *insignis*, the only very close relative of which is the here-described *C. hystrix*, of eastern Peru. These two species comprise a well-marked species-group, and are the sole representatives of the genus so far known from the Amazonian and Guianan regions. They are distinctive in the divided and process-bearing interstylar portion of the ultimate sternite (subgenital plate) of the male. These processes in *insignis* bear heavy mats of recurved chaetiform spinules, while in *hystrix* each carries instead four or more strong spiniform teeth. In addition to these differential features are other distinctive ones set forth in the diagnosis of *hystrix* and the preceding key to the species.

**Cahita hystrix** new species (Pl. XIV, figs. 6 and 7.)

More nearly related to *C. insignis* (Hebard) than any other species, but readily separable by its larger size, and less ovate pronotum, the broader, blunter and less elongate lanceolate tegmina, the shorter and broader anal field of the same, by the more elongate and less bulbously inflated ultimate palpal article, the broader, trigonal but apically emarginate ultimate tergite (supra-anal plate) of the male and also the presence of four or more spiniform teeth on paired median processes on the distal margin of the ultimate sternite (subgenital plate) of the same sex.

*Type.*— ♂ ; Teffe, State of Amazonas, Brazil. December 12, 1919. (H. S. Parish). [Hebard Collection, Type no. 1293].

Size larger than in *C. nahua;* general form similar but pronotum less transverse.

Head subcordiform, genal borders strongly converging to the buccal region, greatest width across eyes subequal to greatest head depth; occipital interspace between eyes equal to two-thirds that between antennal scrobes, maxillary palpi with ultimate article twice as long as penultimate, both of the same general character as in *C. nahua,* but ultimate slightly more narrowing distad when seen in profile.

Pronotum septagonal in general outline, slightly broader across greatest width than greatest median length (as 8.25 to 6.5), cephalic border greatly arcuate, latero-cephalic margins oblique subarcuate, latero-caudals similar, caudals broadly converging obtuse-angulate, all angles of passage well rounded except the latero-caudal ones, which are more narrowly so.

Tegmina of the type usual in the genus, the length four times that of the pronotum and three times the greatest tegminal width, apex rounded rectangulate: marginal field relatively broad, reaching distad only to three-fourths the length of the anal field; marginal field at widest point forming slightly more than three-eighths of the total tegminal width; anal field elongate subpyriform in outline, length two and one-half times its greatest width: humeral trunk appreciably arcuate in proximal two-fifths; costal veins eighteen to twenty in number, straight oblique, in general parallel; discoidal sectors (of all origins and degrees of completion) eleven in number; anal vein joining sutural margin at eleven twenty-fifths of the length of the latter from its base, much of its distal half virtually straight oblique; intercalated venation and cross nervures producing a somewhat paler and rather fine areolate pattern suggesting that seen in many of the members of the Old World group Maretae, to which the superficial resemblance is very great, even more so than in the other species of the present genus.

Ultimate tergite (supra-anal plate) relatively transverse, the median produced portion alone with its greatest median length not exceeding half the width between the cercal bases, its shape broadly trigonal, the lateral margins obliquely converging, the apex very broad, subbilobate, mesad subconcave, this area of the margin with long sparse bristles: ultimate sternite (subgenital plate) transverse, its greatest median length equal to but a third of the proximal width of the sternite, roughly shallow rectangulate, lateral margins nearly straight, weakly convergent, distal margin shallowly triconcave, the median one slightly deeper and more heavily cingulate than the lateral ones, on each side of it at the juncture with the flanking concavities is placed a non-articulate, short, but broad and subpalmate, subvertical process, the greatest length of which is not greater than that of the sternite itself, the distal section of the process with three distinct, long and stout spiniform teeth, of which the dorsal is the longest, straightest and most slender, the ventral more recurved and relatively short,[12] in addition at its internal base the process has one or two shorter, but still strongly-developed teeth; styles inserted laterad in the lateral concavities of the distal margin of the ultimate sternite, simple, tapering, slightly arcuate, in length subequal to the width of the respective concavities of the margin: cerci as usual in the genus.

Cephalic femora with ventro-cephalic margin with three proximal large spines, paired distal spines markedly dissimilar in length. Caudal tarsi with proximal article a fourth again as long as the more distal ones combined.

General coloration ochraceous-buff, largely tinted with ochraceous-orange, the micro-tessellation produced by the tegminal areolets giving an impression of dull zinc orange. Eyes mummy brown. Head, palpi and pronotal disk well tinted with ochraceous-orange, limbs and abdomen largely lacking this. Antennae pale ochraceous-tawny. Lateral areas of pronotum clear hyaline to washed with light ochraceous-buff, marginal field of tegmina of the same color. Limb spines ochraceous-tawny, paler proximad. Processes of ultimate sternite ochraceous-tawny, spines russet tipped.

Length of body, 16 mm.; length of pronotum, 3.78; greatest width of pronotum, 4.78; length of tegmen, 14.6; greatest width of tegmen, 4.62.

The type of this most distinctive species is unique.

**Cahita borero**[13] new species (Pl. XIV, figs. 8-12.)

The present species forms with *C. linguata* a very distinct species-group, characterized by the subtrigonal shape of the ultimate sternite (subgenital plate) of the male, the ventral surface of which bears distad a short, linearly disposed, medio-longitudinal series of short, recurved teeth. From *C. linguata*, described on a following page, *borero* can readily be separated by quite distinctive features set forth in the key to the species. Both *borero* and *linguata* occur in south-central South America, where so far as known they are the sole representatives of the genus.

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[12] On the dextral process we find a short dorsal tooth in addition to the three as on the sinistral one.

[13] After the Borero, the native people of the pantanal country of the upper Rio Paraguay, Brazil. These natives can still be found living in truly primitive conditions on the Rio São Lourenço tributary of the Rio Paraguay, and were there visited by members of the Matto Grosso Expedition.

*Type.*— ♂ ; Descalvados, Rio Paraguay, Matto Grosso, Brazil. Elevation, 560 feet. September 27, 1931. (Matto Grosso Expedition, J. A. G. Rehn; beaten from tree foliage in dry scrub). [Academy of Natural Sciences of Philadelphia, Type no. 5547].

Size medium; form moderately depressed.

Head hardly evident from dorsum; in outline trigonal, cordiform, faintly broader across eyes than deep; interspace between eyes equal to three-fourths the length of the proximal antennal article, and slightly greater than half the interspace between the ocellar spots; antennae somewhat exceeding the body in length, except proximad rather distinctly clothed with short setae; palpi with ultimate article slightly more than one and one-half times as long as the very greatest,[14] and twice as long as the axial length of the penultimate article, markedly inflated as usual in the genus, elongate scoop-shaped.

Pronotum roughly heptagonal, its greatest width equal to one and one-half times the greatest length; cephalic margin weakly arcuate, passing into caudad diverging, nearly straight latero-cephalic sections, which then narrowly pass into shorter, caudad converging, nearly straight portions, these broadly rounding into the two very broadly obtuse-angulate joined caudal sections; surface of disk moderately declivent in the latero-cephalic areas.

Tegmina somewhat surpassing the abdominal apex, elongate lanceolate, subequal in width, greatest width contained slightly more than three times in tegminal length: costal margin nearly straight for most of its length, more distinctly arcuate proximad and distad to the apex, which is narrowly rounded; sutural margin nearly straight for more than half its length, rather sharply arcuate proximad to tegminal base and more broadly oblique arcuato-truncate to apex distad: marginal field relatively broad, its greatest width contained two and one-half times in that of anal field, its greatest length contained two and four-tenth times in tegminal length, acutely narrowing distad; scapular field broad, its greatest width equal to three-sevenths that of the entire tegmen; anal field elongate subpyriform, its greatest width to length as 3.5 is to 10: mediastine vein straight oblique distad from its point of divergence from the humeral trunk; costal veins nineteen in number, certain of the more distal ones bifurcate to biramose, all regularly oblique, only in part subarcuate; discoidal vein undivided;

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[14] Distal margin of the penultimate article is obliquely subtruncate.

discoidal sectors ten in number, longitudinal; anal sulcus joining sutural margin at five-twelfths of the tegminal length; axillary veins seven in number. Wings reaching to tegminal apices when in repose, in proportions with greatest width equal to about two-thirds of greatest length: costal veins with five developed from the mediastine vein, and seven from the discoidal vein, all strongly oblique, the distal bifurcate, none thickened; discoidal vein with its main shaft undivided, distad of costal veins it bears three rami, the more proximal two bifurcate; ulnar vein with four complete and two incomplete rami; intercalated triangle small.

Dorsal surface of abdomen with specialization limited to the proximal tergite and consisting of a pair of lateral, transversely disposed invaginations, the dorsal flap of same thickened and lip-like, its under surface finely shagreenous: penultimate tergite with the acute caudo-lateral productions sharply indicated, caudal margin between very broadly low arcuate with a faint median emargination: ultimate tergite (supra-anal plate) with its greatest proximal width equal to twice median length of tergite, intercercal portion triangularly produced, converging lateral portions of the margin shallowly and subobtusely concave, distal extremity narrowly rounded, surface of median production of tergite transversely impressed between cercal bases, and thence distad sublongitudinally impressed on each side of a median, low rounded area extending to the apex: ultimate sternite (subgenital plate) in general form subquadrate, slightly transverse; lateral margins weakly converging to marked and rectangulate angles briefly laterad of the stylar bases; distal margin obtuse-angulate produced mesad, this area slightly flexed dorsad of the broad, generally deplanate prestylar section of the sternite, and bearing on the median line a short series of four stout, strongly recurved teeth; styles simple, equal in length and development, as long as one-third the distance across the distal margin between the lateral angles, symmetrically placed, sparsely supplied with rather long setae; genital hook stout proximad, the flexed distal portion strongly bent down against the dorsal surface at the median flange, shape as in plate XIV, figure 9: cerci simple, tapering, subequal in length to proximal width of ultimate tergite.

Cephalic femora with ventro-cephalic margin bearing two distal spines, the more distal one half again as long as the more proximal, the spaced proximal group of five large spines with the three more proximal ones somewhat larger than the other two, the area between the proximal and distal groups of spines with six short, small, spaced spinules: median and caudal limbs moderately robust; caudal tarsi with other articles together but seven-tenths as long as proximal. External tarsal claw very short, not more than half the length of the internal one, arolium large.

*Allotype.*— ♀; Formosa, Formosa Province, Argentina. December 16, 1917. (P. Jorgensen). [Academy of Natural Sciences of Philadelphia].

Differing from the description of the male, given above, in the following noteworthy features.

Form shorter, broader, somewhat heavier, tegmina and wings less elongate and proportionately broader.

Head in cephalic aspect with depth and greatest width across eyes subequal; interspace between eyes equal to length of proximal antennal article.

Pronotum slightly more longitudinal, the greatest width equal to about one and one-third times the greatest length.

Tegmina not surpassing the abdominal apex, their greatest width contained three times in the tegminal length; costal margin as a whole slightly more arcuate than in male, apex broader, more fully rounded and less oblique arcuate suturad than in male: marginal field with its greatest length contained two and three-fifth times in greatest tegminal length; greatest width of scapular field subequal to half the greatest tegminal width: costal veins ranging from fourteen to fifteen, with a number of the more distal ones bifurcate or even biramose; discoidal rami seven in number; anal sulcus joining sutural margin very faintly proximad of its middle. Wings with their apices very slightly surpassing the tegminal tips when in repose: costal veins with five developed from the mediastine vein and five from the discoidal vein, most of the latter group bifurcate; ulnar vein with three complete and one to two incomplete rami.

Abdomen with none of the tergites specialized; ultimate tergite (supra-anal plate) in general form as in male, but broader, more transverse and less produced mesad, the greatest proximal width equal to two and one-third times the median length of the tergite; penultimate tergite with caudo-lateral productions much less pronounced and obtuse-angulate; ultimate sternite (subgenital plate) broad, distal margin low arcuate mesad.

Cephalic femora as in male except that the proximal group of spines on ventro-cephalic margin is but two to three in number. Caudal tarsi with proximal article subequal to combined length of others.

*Coloration.*—Ochraceous-buff, in an intensive extreme deepening to ochraceous-orange, the narrow cephalic and caudal and broad lateral areas of the pronotum, and marginal field and costal section of scapular field of the tegmina clear hyaline or at most lightly clouded with ochraceous-buff, the latter condition independent of and not correlated with the intensive color extreme. Head of general color, with area between eyes and ocellar spots to a variable degree washed with zinc orange; ocellar spots light buff to light ochraceous-buff; eyes mummy brown, either solid or speckled with dresden brown; antennae and palpi of the general color. Pronotal disk either solidly of the general color or of this marked with a rather complicated, scroll-like, sublyriform pattern of ferruginous to hazel, usually at least some part or trace of the pattern being present. Tegmina with a tessellate areolar micro-pattern of tawny present to a greater or lesser degree all over those portions of the tegmina of the general color, often very faint and again as emphasized as a similar pattern is in species of the blattid genus *Mareta*, in the scapular field progressively obsolete as the subhyaline costal border is neared. Wings with membrane faintly washed with ochraceous, veins pale ochraceous-tawny. Abdomen and limbs of the general color.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| ♂, Descalvados, Matto Grosso, Brazil, *type* | 13 | 3.02 | 4.53 | 13.9 | 4.03 |
| ♂, Corumbá, Matto Grosso, Brazil, *paratype* | 13.9 | 3.19 | 4.36 | 13.5 | 3.86 |
| ♂, Urucum, near Corumbá, Matto Grosso, Brazil, *paratype* | 14.2 | 3.86 | 5.29[15] | 16.6 | 4.62 |
| ♂, Chapada, Matto Grosso, Brazil, *paratype* | 15.2 | 3.44 | 4.87 | 16 | 4.28 |
| ♂, Chapada, Matto Grosso, Brazil, *paratype* | 15 | 3.86 | 5.12 | 16.5 | 4.62 |
| ♂, Viannopolis, Goyaz, Brazil, *paratype* | 17.2 | 3.94 | 5.12 | 17.8 | 4.95 |
| ♂, Lassance, Minas Geraes, Brazil, *paratype* | 16 | 3.61 | 4.95 | 16 | 4.7 |
| ♀, Corumbá, Matto Grosso, Brazil, *paratype* | 13.3 | 3.78 | 5.37 | 15 | 4.52 |
| ♀, Urucum, near Corumbá, Matto Grosso, Brazil, *paratype* | 13.5 | 3.94 | —[16] | 14.1 | 4.45 |
| ♀, Chapada, Matto Grosso, Brazil, *paratype* | 12.5 | 3.69 | 5.54 | 16.3 | 5 |
| ♀, Viannapolis, Goyaz, Brazil, *paratype* | 15 | 4.03 | 5.04 | 15.3 | 4.53 |
| ♀, Formosa, Formosa, Argentina, *allotype* | 14 | 3.52 | 4.53 | 12 | 4.03 |

In addition to the type and allotype, I have before me the following adult individuals, which may be considered paratypes:

Corumbá, Matto Grosso, Brazil; April (2); (H. H. Smith); 1♂, 2♀; [Carnegie Museum].

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[15] Pronotum somewhat flattened, width slightly too great.

[16] Pronotum damaged on one side.

Urucum, near Corumbá, Matto Grosso, Brazil; December 23–29, 1919; (Cornell Univ. Exped.); 1 ♂, 1 ♀; [Cornell Univ.].

Chapada, Matto Grosso, Brazil; May, June, August, September, November; (H. H. Smith); 2 ♂, 3 ♀; [Carnegie Museum].

Viannopolis, Goyaz, Brazil; November, 1931; (R. Spitz); 1 ♂, 1 ♀; [Museu Paulista].

Lassance, Minas Geraes, Brazil; November 9–19, 1919; (Cornell Univ. Exped.); 1 ♂; [Cornell Univ.].

The color description covers the range seen in this feature, while the measurements given above present very clearly the marked range in size variation. It appears that there is a definite geographic or environmental correlation of size, the smaller individuals of both sexes being from low down along the Rio Paraguay (Formosa, Corumbá and Descalvados), while the longer, more amply alate specimens are from more elevated regions, chiefly to the northward (i.e. Chapada, Viannopolis and Lassance). While Urucum is very close to Corumbá it is much higher, on the isolated and montane Massiço do Urucum, an entirely different area from that of the low pantanal along the Rio Paraguay but a few miles away. This isolated and ancient monadnock apparently exercises somewhat the same influence on its life as do more elevated areas some hundreds of miles to the northward. The author had the privilege, while on the Matto Grosso Expedition, to visit the Corumbá district and is, in consequence, familiar with its physiography.

There are also before me four immature individuals of the species from the Descalvados area and one from Corumbá. The data on these specimens are as follows:

Descalvados, Matto Grosso, Brazil; July 8, 1931; (Matto Grosso Expedition, J. A. G. Rehn; beaten from foliage of tree on edge of dry riverine tangle); one immature ♂; one immature ♀.

Santa Rosa de Descalvados, Matto Grosso, Brazil; July 16, 1931; (Matto Grosso Expedition, J. A. G. Rehn; beaten from undergrowth in a dry forest area); one immature ♀.

Carne de Vaca, eight miles south of Santa Rosa de Descalvados, Matto Grosso, Brazil; August 13, 1931; (Matto Grosso Expedition, J. A. G. Rehn); one immature ♂.

Corumbá, Matto Grosso, Brazil; December 14 to 23, 1919; (Cornell University Exped.); one immature ♂ : [Cornell Univ.].

All of these specimens are in the instar preceding maturity.

**Cahita linguata**[17] new species (Pl. XIV, figs. 13 and 14.)

The chief features of difference of this species from *C. borero* have been given in the key.

*Type.*—♂ ; Chapada, State of Matto Grosso, Brazil. November. (H. H. Smith). [Carnegie Museum].

The characters given in the present description are those of difference from the preceding ample one of the closely related *borero.*

Size rather large;[18] form as in *borero.*

Head and pronotum essentially as in *borero;* palpi with shape and proportions as in that species.

Tegmina as in *borero;* anal field with greatest width to length as 4.25 is to 12, its apex more narrowly rounding to distal margin, less broadly arcuato-truncate; costal veins sixteen to eighteen in number, the more distal bifurcate to biramose as in *borero;* discoidal sectors nine in number. Wings fundamentally as in *C. borero*: four costal veins originating from the mediastine vein and seven from the discoidal, the distal two bifurcate; ulnar vein with three complete and three incomplete rami.

General abdominal structure as in *C. borero*: ultimate tergite (supraanal plate) with its median section produced into a prominent acute linguiform process, which reaches caudad of the ultimate sternite (subgenital plate) a distance equal to a fourth the length of the process, narrow proximal section of the tergite strongly transverse, the lateral margins of the median process evenly concave about the cercal bases and extending in a weakly sigmoid fashion convergingly to the narrowly rounded apex of the median process, the median length of the production from the inter-cercal axis being but faintly shorter (5 to 5.5) than the distance between the internal margins of the cerci at the inter-cercal axis; dorsal surface of median process of ultimate tergite slightly deflexed, subexcavate, margins of distal half of process bordered ventrad by a regular series of short chaetiform spines: cerci as in *borero*: ultimate sternite (subgenital plate) of the general form seen in *borero* but less symmetrically quadrate when seen in ventral aspect, the line of reflexion of the distal section of the sternite not being transverse but oblique, and the styles not symmetrically inserted, the socket of the sinistral being somewhat closer to the sternite's base than is that of the dextral one, the more strongly and sharply dorsad deflexed (interstylar) portion being broad trigonal, the angle of the apex narrowly obtuse, sharper than in *borero;* the median series of recurved teeth on the ventral surface numbering four, and in character similar to that found in *borero;* styles similar to those of *borero* but slightly more robust.

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[17] In allusion to the tongue-shaped production of the ultimate abdominal tergite (supra-anal plate) of the male.

[18] Appreciably larger than the type of *borero,* but subequal to some of the male paratypes of that species from Chapada, whose measurements are given above.

Limbs as a whole more slender and elongate than in *borero;* cephalic femora with spination as in *borero;* caudal tibiae with proximal subequal to length of other articles combined.

Coloration as in *C. borero,* the tegmina with the micro-pattern well developed and of exactly the same type.

Length of body, 15.3 mm.; length of pronotum, 3.61; greatest width of pronotum, 5.29; length of tegmen, 16.5; greatest width of tegmen, 5.20.

The type of this quite distinct species is unique.

## BLATTINAE

**Eurycotis histrio**[19] new species (Pl. XV, figs. 19 and 20.)

This very distinctive new species needs comparison with but two of the species of the genus previously known. These are both Cuban in distribution, i. e. *E. flavipennis* Saussure and Zehntner[20] and *E. cribrosa* Rehn and Hebard.[21] With *flavipennis,* which is incompletely described and of which I know solely the description, the present species agrees in the marked expansion and surface sculpture of the caudal tibiae and in the contrasted yellow tegmina, but from which it differs in the broader tegmina, these being described as "anguste squamiformia", which are also nigro-punctate instead of presumably unicolorous yellow, the particolored instead of black head, in the rufescent lateral borders of the pronotum, the general deep chestnut base color of the nota and the pale transverse proximal barring of the abdominal tergites. As a large part of the diagnostically brief description of *flavipennis* is based on color, and structure is less stressed, doubtless a physical comparison of the two species, which are based on opposite sexes, will show other features of differentiation. The structure of the caudal tibiae shows that *histrio* falls into the group containing the Cuban *flavipennis* S. and Z., the Hispaniolan *tibialis* Hebard and the presumably Jamaican *lixa* Rehn, which agree in this characteristic.

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[19] I. e. *a player,* in allusion to its harlequin-like color pattern.

[20] Biol. Cent.-Amer., Orth., I, pp. 70, 71, (1893). [♀, Cuba.] For comments see Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., LIV, p. 179, (1927).

[21] Bull. Amer. Mus. Hist., LIV, pp. 156, 185, pl. 14, fig. 9, (1927). [♀; Los Caños, Guantánamo (type) and Baracoa, Oriente, Cuba.]

With *E. cribrosa* R. and H. the present species agrees in the contrasted coloration of the tegmina, which are yellow with blackish puncta in both, but from it *histrio* differs in its expanded and differently sculptured caudal tibiae, as well as the more slender form, the far finer and more closely impresso-punctulate texture of the surface of the dorsum, the narrower pronotum, the narrower tegmina, more slender cerci, the more broadly pyriform and less cordiform head, the occipital line of which is more arcuate and the interocular space greater in proportion, the limbs shorter and stouter, the proportionately shorter proximal caudal tarsal article and in the pulvillus of the latter being apical and not extending toward the base as a narrow spur.

It is evident to me that the relationship of *histrio* is clearly with the Tibialis Group and not with that to which *cribrosa* belongs, the resemblance to the latter being less fundamental, as the development of the pulvillus of the proximal tarsal article indicates.

*Type.*—♂; Northeastern foothills of Massif La Hotte, southwestern peninsula of Haiti, Hispaniola. Elevation, 2000–4000 feet. October 10, 1924. (P. J. Darlington, Jr.). [Museum of Comparative Zoology].

Size medium (for genus); form elongate elliptical, tegmina lateral, lobiform, wings absent; surface in large part cribrosely impresso-punctate, head and venter more sparsely so than elsewhere.

Head with occipital region and portions of the eyes visible from dorsum, seen in cephalic aspect the outline is very broad cordiform, the greatest width across eyes (at ventral third of same) subequal to the greatest depth of the head, occipital outline in same aspect strongly arcuate, continuous with the curvature of the eyes; interspace between eyes very broad (particularly for the male sex), equal to one and one-third times that between the internal margins of the antennal scrobes, infra-antennal areas of face moderately thickened and substrumose, in contour appreciably differentiated from the subconcave median portion of the supra-clypeal section of the face: antennae faintly longer than the body, proximal article nearly twice as long as the third: palpi with antepenultimate article one and one-third times as long as the penultimate, slightly arcuate; penultimate markedly infundibuliform; ultimate equal in length to the antepenultimate, triangularly securiform.

Pronotum in outline as seen from dorsum semi-ovate with cephalic (dorsad of head) margin truncate and caudal one subtruncate, the greatest width, which is across the caudo-lateral angles, equal to one and two-fifth times the greatest median length: truncate cephalic margin equal to slightly less than half of greatest pronotal width, passing into the distinctly arcuate, caudad diverging lateral margins, the caudo-lateral angles narrowly rounded rectangulate; caudal margin subtruncate, faintly sinuate; in transverse section the whole pronotum is regularly arcuate, not at all differentiated into a disk and lateral areas; lateral and cephalic margins distinctly cingulate, the latter more narrowly so, caudal margin simple.

Tegmina lateral, subquadrate, greatest width subequal to length, not surpassing caudal margin of mesonotum, separated mesad by a distance approximately equal to twice the tegminal width: costal margin markedly cingulate, nearly straight mesad, briefly arcuate proximad and more extensively so distad to the disto-lateral angle, which is well rounded; sutural margin moderately arcuate, disto-lateral angle obtusely rounded; distal margin weakly oblique arcuato-truncate: surface of tegmina with numerous subcribrosely impressed punctations, no indication of a humeral trunk or other venation present. Wings absent. Lateral margin of metanotum cingulate.

Abdominal tergites, except ultimate, with lateral margins cingulate as on metanotum, caudo-lateral angles slightly acute produced caudad, distal margins of tergites one to six truncate, of seventh weakly arcuate: ultimate tergite (supra-anal plate) transverse, distal margin arcuate with a relatively and shallow, but quite definite, obtuse-angulate emargination: cerci relatively short, not surpassing ultimate tergite, broad fusiform, apices blunt acute, dorsal surface deplanate. Ultimate sternite (subgenital plate) strongly transverse, symmetrical, the broad interstylar section of the distal margin, which occupies two-thirds of the sternite's total breadth, arcuate, somewhat more flattened mesad, stylar fossae well marked, very definitely emarginating the border, extreme lateral sections of the sternite strongly arcuate sublobiform; ventral surface of median portion of sternite transversely subconcave intramarginally: styles tapering, simple, apices blunt acute, surface distad sparsely setigerous, the length slightly greater than one-third the distance between their bases.

Limbs very robust, relatively short: cephalic femora without, median and caudal each with a stout genicular spine; cephalic femora with two unequal spines in the distal group on the ventro-cephalic margin, the ventro-caudal with a single, much smaller, distal spine, median and caudal femora with a single distal spine on each ventral margin: ventro-cephalic margin of cephalic femora with seven spaced spines, the ventro-caudal with three; ventro-cephalic margin of median and caudal femora each with three small spaced spines, the ventro-caudal of the same with four larger ones: cephalic tibiae subclavately fossorial; median tibiae markedly compressed, very broad; caudal tibiae very broad and strongly compressed, in outline subfusiform, the extensor side of the sublamellation markedly ovate subexcavate on caudal face, in fact subauriculiform in outline, this on cephalic face represented by a more restricted and longitudinal intramarginal concavity, extensor surface spines triseriate, the median and caudal rows very heavy and elongate, their length equal to the tibial width, while both rows have the spines much more erect than the decumbent cephalic row; caudal tarsi subcompressed, length of proximal article equal to seven-seventeenths of the total tarsal length, and subequal to the combined length of the second to fourth articles, pulvillus of proximal article covering two-fifths of the venter of the article; tarsal claws equal; arolia large.

Coloration: General tone deep fuscous, with all of the nota showing definite intimations of a very deep maroon wash. Head with occiput and face dorsad of an interantennal line mahogany red, lower part of face transversely solid deep fuscous, marked infra-antennally with apricot yellow, clypeus and labrum apricot yellow, mandibles hay's russet; eyes bister; antennae ferruginous, increasingly washed with liver brown proximad; palpi ochraceous-buff, washed, and particularly the ultimate article, with buckthorn brown. Pronotum with lateral intramarginal borders of mars orange, extending between, but not on, the cephalic and caudal margins, immediate lateral margins narrowly fuscous. Tegmina primuline yellow, costal margin maroon, a spot proximad on the sutural border blackish fuscous, impressed surface puncta blackish fuscous, largest mesad, becoming progressively smaller suturad. Abdominal tergites two to seven with narrow proximal transverse barring of mikado brown;[22] apex of abdomen, including cerci and styles, of the general color with a definite amount of maroon wash. Limbs vinaceous rufous to brick red, darkening on the tibiae and tarsi, the caudal of these of the maroon toned general color, the immediate extensor face of the tibiae nearer hay's russet; coxae largely deep fuscous over ochraceous-tawny, more or less completely but narrowly bordered with light ochraceous-buff.

Length of body, 22.6 mm.; length of pronotum, 6.2; greatest width of pronotum, 8.6; length of tegmen, 2.91; greatest width of tegmen, 2.68.

The type of this striking species is unique.

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[22] The abdomen is extended in the unique type, and this feature may be less evident when the abdomen is retracted. However, it is a very marked color feature and the involved areas show by their texture that at least a distal section of this pattern is normally exposed.

## EPILAMPRINAE

**Dryadoblatta**[23] **mira** new species (Pl. XV, fig. 21.)

Compared with *D. scotti* (Shelford),[24] the genotypic and sole previously known species of the genus, of which a topotypic female is now before me,[25] the present species differs in both sexes in the abbreviate and subquadrate tegmina, which reach only to the base of the abdomen, in the proportionately more reduced wings, in the distinctly serrate lateral margins of the sixth, seventh and eighth abdominal tergites, as well as the complete or lateral spaced spiculate spination of the caudal margins of the same, in the more elongate and slender femora and tibiae but proportionately shorter tarsi, particularly the proximal article of the caudal pair, as well as the contrasted pale occiput and dark face, instead of uniformly rufescent head. In addition the female of *mira* differs from that sex of *scotti* in the ultimate tergite (supra-anal plate) being more trigonal, the lateral margins more oblique arcuate, and the median emarginate less decided.

*Type.*—♂; Mount Duida, Venezuela. February, 1929. (G. H. H. Tate). [American Museum of Natural History].

Size large: form elliptical, brachypterous, tegmina hardly longer than pronotum: surface as a whole polished.

Head from dorsum very narrowly visible cephalad of the pronotum, seen in cephalic aspect broad cordiform, its greatest depth very faintly greater than the width across eyes; occipital interspace between eyes slightly greater than that between internal margins of antennal scrobes (as 5.8 to 5); occipital outline low arcuate, continuing the general curvature of the eyes; face subdeplanate mesad: antennae slightly longer than half the body, third article from base equal to three-fourths the length of the proximal one, the former no thicker than the article immediately distad, the latter much stouter: palpi with ultimate and antepenultimate articles subequal in length, penultimate slightly shorter (as 4 to 4.5) and markedly infundibuliform, ultimate quite slender, subsecuriform in profile.

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[23] The genus *Dryadoblatta* was established by me in 1930 (Trans. Amer. Entom. Soc., LVI, p. 56), to include the very striking species from Trinidad described by Shelford in 1912 as *Homalopteryx scotti*. When describing the genus I pointed out the wide divergence of it from true *Homalopteryx* and discussed the numerous features distinguishing *Dryadoblatta* from *Pinaconota* of Saussure, which is probably its nearest known ally.

[24] *Homalopteryx scotti* Shelford, Ann. and Mag. Nat. Hist., (8), x, p. 431, pl. 10, figs. 1 and 2, (1912). [♂, ♀; Summit of Mount Tucuché, Trinidad, 3100 feet elevation.]

[25] Mount Tucuché, Trinidad, 2000-3000 feet; I, 17, 1924; (Dr. S. A. Neave); [Hebard Collection, in exchange with Brit. Mus. Nat. Hist.].

Pronotum transverse trigonal, its greatest median length contained one and two-third times in greatest width, which is at caudal margin; cephalic margin narrow, low arcuate, passing evenly into the oblique arcuate, diverging lateral margins, caudo-lateral angles narrowly rounded subacute-angulate, caudal margin distinctly transverse, obscurely subconcave in each half; margins cingulate throughout, nowhere broadly so and very narrowly bordered in supra-cephalic area: surface of pronotum low arcuate transversely, very slightly embracing the head cephalad.

Tegmina subquadrate, greatest width equal to approximately five-sixths of the tegminal length, reaching only to distal margin of second tergite, overlapping mesad: costal margin evenly arcuate, disto-costal angle distinct but well rounded; distal margin transverse subtruncate; sutural margin nearly straight, disto-sutural angle rectangulate, very narrowly rounded: marginal field broad, its greatest width equal to one-fourth the greatest width of the tegmen, surface sparsely impresso-punctate; anal field very broad, occupying two-thirds of tegminal length along sutural margin: humeral trunk but weakly and not at all clearly defined on dorsal surface, on ventral surface represented proximo-mesad by a pronounced but rounded, elevated welt-like ridge, obsolete proximad and distad; multiple radiate venation of scapular and discoidal fields and the axillary veins (15) of the anal field indicated by a pattern of impressed puncta; anal vein obsolete proximad, mesad and distad strongly arcuate, forming a segment of a full quadrant, well incised only in sutural fourth. Wings greatly reduced, completely hidden under tegmina, functionless.

Dorsum of abdomen moderately deplanate, faintly broader, at widest point, than pronotum, caudo-lateral angles of third to seventh tergites spiniform produced caudad, progressively more decided caudad, distal margins of same tergites transversely subtruncate, subconcave on sixth and seventh, lateral margins of fifth to seventh tergites distinctly serrate, distal margins of all exposed tergites to and including seventh with from one (second tergite) spiniform erect tubercle laterad to an entire transverse spaced series of the same on the seventh, the number, extent of series and emphasis of these unusual erect structures increasing distad from the base of the abdomen to the seventh tergite; eighth tergite narrow, strongly transverse, lateral spiracular processes subacute produced: ultimate tergite (supra-anal plate) transverse trigonal, greatest median length contained two and one-fourth times in greatest proximal width, converging lateral margins moderately arcuate, median emargination moderately incised subrectangulate, the flanking lobes rounded, dorsal surface of tergite declivent in proximal three-eighths, sharply deplanate in distal five-eighths, the line of demarcation transverse and finely impressed except laterad, proximad of disto-median emargination of margin a distinct sulcation extends nearly half way to tergite's base: cerci reaching nearly as far distad as the distal point of ultimate tergite, stout, proximal width approximately half of length, deplanate, acutely tapering in distal half: ultimate sternite (subgenital plate) subtrigonal, median length approximately half of proximal width, slightly asymmetrical, lateral margins converging to the broadly rounded apex, dextral stylar fossa more extensive and more longitudinally excavate than sinistral, the dextral style being placed in a definite groove; styles simple, small, subequal in length, which is approximately one-fourth the median length of the ultimate sternite.

Cephalic femora lacking the genicular spine, median and caudal with same distinctly developed; cephalic femora relatively narrow, little inflated, unarmed ventrad except for a closely placed pair of unequal spines distad on the ventro-cephalic margin and a more widely spaced distal pair of equal length on the ventro-caudal margin; median and caudal femora but moderately robust, greatest depth of latter contained three and nine-tenth times in the length of the same, ventro-cephalic margin of median femora with five spaced spines, one being distal, ventro-caudal margin also with five spines but of distinctly larger size, ventro-cephalic margin of caudal femora with four spaced spines, one distal, ventro-caudal margin of same also with four larger spines, none, however, being distal in position: caudal tarsi with proximal article equal to four-ninths of the total tarsal length, pulvillus strongly developed on same, extending proximad two-thirds of the article's length; tarsal claws equal; arolium large and broad.

*Allotype.* — ♀; same data as type except date is January 1, 1929.

The following description of the allotype is almost solely of features differing from the above description of the male.

Head in cephalic aspect with length and breadth subequal; occipital interspace between eyes appreciably greater than that between the internal margins of the antennal scrobes (as 6 to 5); deplanation of face somewhat more extensive, reaching definitely to the interocular area.

Pronotum, tegmina and wings as in male.

Abdominal tergites with the caudo-lateral angles of third to seventh tergites less decidedly produced, although very definitely spiniform, lateral margins of fifth to seventh tergites as serrate as in male, spination of distal margins of tergites similar but slightly less markedly spinigerous than in male: ultimate sternite (supra-anal plate) of same general shape as in male but faintly more transverse, its median length equal to half of proximal width, median emargination of margin shallower, obtuse-angulate, surface of tergite without a transverse impression, evenly declivent distad, subconcave laterad near cercal bases; cerci similar to but smaller than in male; ultimate sternite (subgenital plate) transverse trigonal, median length slightly less than half of greatest proximal width, lateral portions of distal margin obliquely convergent, faintly sinuate ventrad of the cerci, apex relatively broad, arcuate subtruncate, rounding into the lateral portions, surface of sternite subdeplanate, broadly and shallowly subconcave laterad.

Cephalic femora with the distal group of spines on the ventro-caudal margin numbering three instead of two;[26] other features of limbs as described for the male.

*Coloration.*—General color of dorsal and ventral surfaces and of limbs blackish fuscous, with a liver brown tendency on the tegmina. Broad lateral bands of primuline yellow (allotype) to ochraceous-orange (type) extend from the junction of the cephalic and lateral margins of the pronotum caudad over the pronotum, regularly widening, involving the entire marginal and scapular fields of the tegmina, and narrowly attenuate over a lateral portion of the distal margin of the same, and in the male carried as similar broad lateral borders of the abdominal tergites to and including the three distal ones. The allotype shows of these lateral bands solely ferruginous patches laterad on the seventh tergite and a liver brown tendency marginally on the ultimate one, while the paratypic female has an even weaker and less extensive marking on the seventh tergite. The immediate vicinity of the cingulate lateral border of the pronotum is more distinctly and of the costal margin of the tegmina very finely marked with fuscous. Head of the general color with the occiput contrastingly pale, agreeing with the lateral bands; eyes bister; antennae with the two proximal articles fuscous black, the remainder ferruginous. Limbs fuscous black; tarsi in large part paling to hay's russet; spines hay's russet, fuscous tipped.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| ♂, *type* | 31.8 | 8.6 | 14 | 10.5 | 9.5 |
| ♀, *allotype* | 31.5 | 9 | 13.4 | 9 | 9.3 |

In addition to the type and allotype I have before me a single paratypic female, taken at the type locality in February, 1929, by Mr. Tate, and also with a stated elevation of 4500 feet. This individual is of the same size and character as the allotype, the single colorational difference being noted above.

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[26] This is probably a purely individual feature, and the number to be found in the species probably ranges from two to three. However, both females agree in having three spines instead of two as in the unique male.

## PANCHLORINAE

### PHORTIOECOIDES new genus

Related to *Phortioeca* Saussure,[27] *Capucinella* Hebard[28] and *Capucina* Saussure,[29] showing certain features of agreement with each, but differing from each one by combinations of characters. It agrees with *Capucinella*, and differs from the other genera, in having the adult female apterous and patelliform, while in *Phortioeca* and *Capucina* this is the condition of immaturity alone. The new genus differs in the adult male from *Phortioeca*, and agrees with the other two, in the shape of the pronotum, at the same time agreeing with *Phortioeca* and differing from *Capucinella* and *Capucina* in the proportionately shorter proximal antennal article. From *Capucina* the male of *Phortioecoides* differs, and agrees with *Capucinella*, in the medio-longitudinally carinulate and less coriaceous pronotum, the texture of the tegmina and the character and development of their venation, as well as the very short distal article of the caudal tarsi. From *Capucinella* the male sex of the new genus also differs in the pronounced cucullate "hood" of the supra-cephalic portion of the pronotum, thus agreeing with the other related genera, the less papery texture of the pronotum and tegmina and less attenuate form. The female of *Phortioecoides* differs from that sex of *Capucinella delicatula*, the genotype of that genus, in its pustulose dorsal surface, more cucullate supra-cephalic "hood" of the pronotum, narrower head and interocular space, much shorter proximal antennal article and more abbreviate tarsi.

*Generic Description.*—Male fully alate; female patelliform, apterous. Head concealed by pronotum; eyes well separated in both sexes, interspace subequal to that between ocellar spots; latter prominent and concavo-excavate in male, evident but very small in female; antennae in male thirty-one to thirty-four jointed with proximal article equal to three times the length of succeeding one, in female the former is four times the length of the second, third article in male slightly longer than second, slender, succeeding ones distinctly moniliform, third article in female nearly twice as long as second, thence distad the articles are moniliform; palpi with ultimate article securiform, penultimate infundibuliform. Pronotum of male setoboroid, transverse, acute-ovoid, its cephalic margin arcuate, supracephalic "hood" markedly developed and bullate, not reaching cephalic margin of pronotum, caudal margin broad obtuse-angulate, lateral angles obtuse, surface cephalad medio-longitudinally carinulate, obsoletely so caudad; pronotum of female semicircular, margin broadly arcuate cephalad between slightly acute caudo-lateral angles, caudal margin subtruncate, surface sparsely pustulose; meso- and metanota of female acute produced caudo-laterad, caudal margins of same subtruncate mesad. Tegmina of male surpassing apex of abdomen, lanceolate, apex narrowly rounded, texture subcoriaceous, venational features regular and distinct, areolae large, relatively few, in general subquadrate to subrectangulate, marginal field broad. Wings reaching to tegminal apices. Dorsum of abdomen of female with regular transverse marginal series of pustulose nodes present on each tergite, disto-lateral angles of tergites acute produced, ultimate tergite (supra-anal plate) of female transverse, bisarcuate distad; cerci of female non-articulate, short, stout, subspatulate and deplanate dorsad. Ultimate tergite (supra-anal plate) of male transverse, sub-bilobate distad; cerci of male subfusiform, subdepressed, blunt acute, surpassing ultimate tergite; ultimate sternite (subgenital plate) of male moderately asymmetrical, typically panchloroid; styles markedly lateral in position, small, slender. Median and caudal femora each with a dorsal genicular spine, cephalic lacking same; tibiae with median series of extensor surface spines represented solely by a distal one. Cephalic femora with ventro-cephalic margin armed with a medio-proximal group of five to eight spines followed by an unspined diastema and a single spine on the genicular lobe, ventro-caudal margin unarmed. Median and caudal femora unarmed ventrad. Cephalic and median tarsi with the four proximal articles greately abbreviate, in former pair the more proximal one subequal to half length of distal (ultimate) one; caudal tarsi subequal to half of tibial length, proximal article equal to two-fifths of total tarsal length, its pulvillus trigonal, apical with a narrow extension to base of article along carinate venter; tarsal claws equal in length and simple in structure; arolium large in both sexes.

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[27] Rev. et Mag. de Zool., (2), XIV, p. 232, (1862). Genotype: *Zetobora peruana* Saussure.

[28] Mem. Amer. Entom. Soc., 4, p. 109, (1920). Genotype: *C. delicatula* Hebard.

[29] Societas Entom., VIII, p. 67, (1893). Genotype: *C. cucullata* Saussure (=*Zetobora patula* Walker).

GENOTYPE: *P. guarani* new species.

**Phortioecoides guarani**[80] new species (Pl. XIV, figs. 15-17.)

*Type.*— ♂ ; Horqueta, 40 kilometers east of the Rio Paraguay (57°W., 23°N.), Paraguay. November 6, 1933; taken in copula with allotypic female. (A. Schulze). [Academy of Natural Sciences of Philadelphia, Type no. 5548].

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[80] After the Guarani Indians of Paraguay.

Size small (for group); form depressed, zetoboroid; surface of pronotum in large part shagreenous, tegmina subcoriaceous.

Head in outline, as seen from cephalic aspect, broad cordiform, narrowing ventrad to buccal region, greatest width across eyes subequal to depth of head; outline of eyes moderately full and arcuate, these in shape strongly reniform, seen in profile constricted mesad; line of occiput transversely subtruncate: interspace between eyes contained three and one-half times in greatest width of head (as 12 to 43): ocellar spots large, prominent, in area each greater than that of the adjacent antennal scrobe, subovate in outline, surface distinctly concave; surface of interocellar-ocular portion of head suboblique declivent, with a weak medio-longitudinal carinulation, the interocellar cut off from the more ventral portion of the face by a transversely disposed impression; surface of head as a whole irregularly impressed punctulose: palpi with ultimate article equal to one and seven-twentieths the length of the penultimate (as 19 to 14); antepenultimate relatively robust, narrowing proximad, very slightly longer than penultimate (as 15 to 14): antennae in complete condition (not in type) possessing from thirty-one to thirty-four articles, but slightly longer than twice the depth of the head, the proportionate length of the proximal, second and third articles as 22, 6 and 9 respectively.

Pronotum with median length contained one and three-fifth times in greatest width of same, which is placed very slightly caudad of middle of pronotum: whole cephalic margin between lateral angles arcuate, faintly flattened laterad and subobsoletely emarginate at median point;[31] caudal margin in greater part very broad obtuse-angulate, the immediate median angle rounded, the caudo-lateral sections of the margin short, straight oblique, cut off from the caudal margin proper by a low but quite definite obtuse-angulation, preceded mesad by a slight but definite sinuosity of the margin which then passes to the obtusely angulate caudal margin properly speaking: supra-cephalic cucullation of the surface distinct, well elevated, roundly bullate, but plane caudad and continuous with the caudal section of the remainder of the disk, latero-cephalic portions of the pronotal surface moderately concave, rising regularly to the caudal section of the disk, which bears a weakly defined, smooth, sublyrate pattern, median carination distinct cephalad of and on the adjacent portion of the cucullation, obsolete mesad and poorly defined and broader in caudal half; as a whole the pronotal surface is quite thickly shagreenous by a closely distributed vesture of rasp-like denticles on the dark colored areas, these cephalad on the pale areas, becoming less numerous to obsolete, in both areas, but particularly on the pale areas, are placed numerous well spaced, rounded raised nodules, most of which are intramarginal in position. Ventral surface of broad lateral sections of pronotum cribrosely punctulate, with the same correlation of surface texture with color areas as on dorsum, no carinations or sulci present.

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[31] The last feature is virtually non-existent in certain of the paratypes, but as above in the type.

Tegmina zetoboroid, lanceolate, surpassing apex of abdomen by a distance equal to five-sevenths the length of the pronotum, greatest width of tegmen contained almost three times in length of same, situated slightly proximad of middle: costal margin moderately arcuate in proximal two-fifths, half of remainder straight, thence the margin is lightly arcuate to the narrowly rounded apex; sutural margin very briefly arcuate to base proximad, thence straight for more than half the tegminal length, distad quite broadly arcuate to the apex: marginal field very broad, at widest point but faintly narrower than one-third of length of anal field (as 2.5 to 8), apex of field reaching slightly distad of that of anal field, latter with greatest width slightly less than half of length of same (as 3.5 to 8): surface of tegmina as a whole dully mat, except for the normally covered portion of the right tegmen which, while showing all venational elements, is markedly polished, all venational elements etched in marked relief; marginal field with five to six oblique but subparallel rami of the mediastine vein, which are more evident on ventral surface than on dorsal, tied together by irregularly anastomosing subsidiary veinlets; scapular field proximad with five to six subparallel, occasionally bifurcate, subarcuate rami of the discoidal vein, while distad the same field is irregularly and coarsely subareolate about several additional but more irregular rami of the same vein; discoidal field with seven to eight [32] longitudinal to sublongitudinal (suturad) discoidal sectors, some of which are rami of others, the interspaces divided into quadrate or subrectangulate areolets by cross-nervures, occasionally false intercalated longitudinal divisions breaking the areolets into a double series; anal vein sublongitudinal and nearly straight in proximal two-fifths, thence broadly arcuate to sutural margin, which is joined at two-fifths of its length from base; axillary veins six in number, the more lateral ones less extensive and less complete than the others, interspace areolets as in the discoidal field. Wings ample.

Ultimate tergite (supra-anal plate) with greatest median length equal to twice the proximal width, median emargination of distal margin quite marked, rectangulate, rounding laterad to the more oblique and arcuate lateral sections of the margin, which in turn rounds to the sublongitudinal and nearly straight lateral borders of the tergite: ultimate sternite (subgenital plate) subtrapezoidal with its greatest median length equal to approximately one-half of the proximal width, the asymmetry of the subarcuate margin distinct but not decided, as a whole the sinistral side of the margin more broadly and less sharply arcuate than the dextral the point of greatest length being slightly dextrad of the middle, dextral base with a rectangulate shoulder, followed by a concavity of the margin extending from that base to the usual recurved marginal point, shallow dextral stylar fossa very close to base, sinistral stylar fossa very small, less interrupting the marginal curvature than the dextral, slightly more distal in

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[32] Most of the paratypic males show eight, the type seven only.

[33] Increased to as many as eight in certain of the paratypes.

**position than latter; styles simple, styliform, very slender, dextral one half again as long as sinistral: cerci composed of nine articles, deplanate dorsad, faintly subspatulate, apex subacute.**

**Limbs slender: cephalic femora quite straight, subequal in width, with proximo-median group of spines of ventro-cephalic femora numbering five in type;[38] median and caudal femora slightly arcuate; caudal tarsi with relative length of articles (reading distad) 16: 8: 7: 5: 10.**

*Allotype.*—♀; same data as type. [Academy of Natural Sciences of Philadelphia].

**Size small (for group); depressed, patelliform; surface of entire dorsum finely shagreenous, with an over-pattern of larger spaced elevated boss-like nodes, which are closely grouped and seriate along the caudal margins of the pro-, meso- and metanota and all of the abdominal tergites except several at the apex.**

**Head in outline cordiform, the greatest width across eyes slightly less than the depth of head (as 6.5 to 7.5); interocular portion of outline faintly more arcuate than the outline of eyes, interspace between eyes equal to five-sixths that between internal margins of antennal scrobes; ocellar spots small but distinct, subcircular, slightly less distant than the eyes at occiput; face as whole impresso-punctate, more densely but less deeply so ventrad than dorsad of the transverse interantennal impression: antennae damaged in allotype, in female paratype equal to about twice depth of head, proportions of proximal, second and third articles as 19, 7 and 11 respectively, remaining articles moniliform, progressively lengthening distad, the fourth as 5, the distal as 11.**

**Pronotum roughly semicircular, the greatest width, which is at the caudal margin, being one and five-seventh times the median length; lateral and cephalic margins quite evenly arcuate, faintly flattened meso-cephalad; caudo-lateral angles slightly acute, immediate angles not at all rounded; caudal margin subtruncate laterad, in median section very slightly obtuse-angulate with a slight but distinct more angulate production on median axis: dorsal surface with the disk markedly domed and elevated dorsad of the broad lateral "aprons", the more cephalic portion of the disk formed by the supra-cephalic cucullation and the more caudal portion of the disk as well, which, however, does not reach the cephalic margin, to which the surface is regularly concavo-declivent, as it is laterad from the cucullation and the more caudal portion of the disk as well, which latter is partially marked off from the former by weak but evident converging impressions, median line cephalad of disk sub-carinate with a clustering group of nodes; texture of dorsal surface finely shagreenous, more sparsely so cephalad than elsewhere, with an over-pattern of elevated pustulose nodes, which are also present as a closely placed dentate series along the caudal margin: venter of pronotum cephalad subsulcate beneath the dorsal subcarination, re-**

mainder in general concave with cucullation obscurely delimited, no carinations present, surface shining with scattered shagreenous points.

Mesonotum and metanotum with lateral lappets and caudo-lateral angles acutely produced; caudal margins of same subtruncate mesad, with a median angulate lobation similar to but less definite than that seen on the pronotum, laterad the caudal margins are nearly straight oblique to the caudo-lateral angles; surface texture of meso- and metanota as in pronotum but nodes (other than marginal ones) less marked on median areas.

Dorsum of abdomen with the seven more proximal tergites supplied with marginal dentate series of raised nodes similar to those of the caudal margins of the thoracic nota; distal margins passing from transverse truncate in the second to markedly concave in the seventh; lateral expansions of these tergites projecting markedly laterad of the respective sternites, the caudo-lateral angles acute: ultimate tergite (supra-anal plate) with median length equal to half of proximal width, median emargination of distal margin obtuse-angulate, caudo-lateral angles broadly rounded: cerci equal to two-thirds of median length of ultimate tergite, apices acute: ultimate sternite (subgenital plate) broad, deplanate, greatest proximal width equal to two and one-half times median length of same, general character of margin arcuate, with marked infracercal concavities interrupting the regularity of the same.

Limbs stockier than in male. Cephalic femora with five to six spines[34] in medio-proximal group of ventro-cephalic margin.[35] Median and caudal femora with dorsal margins arcuate, ventral margins straight; median and caudal tibiae distinctly compressed, median short and stocky, its greatest width (lateral aspect) contained two and two-tenth times in its length, caudal tibiae much more elongate, greatest width contained six times in its length: caudal tarsi with the proportions of the articles (reading distad) 23: 10: 8: 10: 18.

*Coloration.*—Male. General color of dorsal surface ranging from cinnamon-brown to prout's brown, involving all the areas normally visible in that aspect except a pair of subtrigonal, connected, translucent, whitish areas cephalad on the pronotum, these latter extending from the median line halfway toward the caudo-lateral angles of the pronotum, but not involving the dark supra-cephalic cucullation, the color of which shades into the translucent areas by coloring the individual shagreenous points and the larger pustulose nodes, while caudad it is continuous with the dark pronotal disk proper. Head largely fuscous-brown to mummy brown, rarely (one Cuyabá paratype) as pale as hay's russet, eyes fuscous; antennae largely fuscous-brown, the proximal article longitudinally marked with dresden brown, which is occasionally a more evident base color of much of the proximal third of the antennae, a preapical annulus of pale ochraceous-buff involves four to five articles, ranging in position from the 21st to 25th to the 24th to 29th, remainder of head of the pale ventral base color, which is ochraceous-buff and also seen on the thoracic sterna, the abdominal venter and the limbs, with an overwash of prout's brown to mummy brown distributed chiefly as follows: clouding of coxae, lining of femoral carinations, and broad washing of median portion of abdominal venter, particularly marked on the ultimate sternite, which is largely of that color margined with the pale base shade, as well as pointing the stigmata and as lateral cloudings.

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[34] In paratypic female there are six spines on one limb and five large and two short (outer) ones on the other.

[35] In the allotype the distal spine on the cephalic genicular lobe has been detached in each cephalic femur, but the sockets are clearly evident. In the paratypic female, however, each of these quite prominent spines is in place.

Female. Base color of dorsum ochraceous-buff, overlaid mesad with a wash of ochraceous-tawny, upon which is superimposed a punctulate pattern of prout's brown to mummy brown, produced by the infuscation of the shagreenous points and pustulose nodes, as well as surface punctulations, the relative density of which governs the depth of the superimposed pattern; median angulate points on the caudal margins of the nota and a number of the scattered pustulose nodes on both the nota and the abdominal dorsum ochraceous-tawny to ochraceous-buff, the scumbling of the abdominal pattern leaving a lateral series of subcircular areas paler than the peripheral surface; lateral expansions of the abdominal terga in general as pale as the broad lateral notal sections. Ventral surface with the same pale base color as dorsum, with an overlaid subvermiculate pattern of russet to mummy brown, similarly disposed on the shagreenous points; median area of abdominal venter washed with prout's brown to mummy brown, also stigmatal spots of the same, while the cephalic border of the lateral expansions of the mesonotum are ventrad blotched with cinnamon-brown. Base color of head and limbs russet to ochraceous-tawny, on the former heavily and almost completely overlaid with a clouding of prout's brown, occasionally (paratype) leaving the occipital interspace pale trivittate longitudinally, eyes wholly or in part fuscous, antennae pale annulate distad as in male but involving article 18 to 21, limbs clouded and lined with prout's brown as in male; cerci bicolored, mummy brown proximad, ochraceous-buff distad.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| ♂, Horqueta, Paraguay, *type* .. | 11.9 | 4.03 | 6.37 | 12.1 | 4.45 |
| ♂, Horqueta, Paraguay, *paratype* ................ | 13.2 | 4.11 | 6.20 | 13.3 | 4.53 |
| ♂, Cuyabá, Brazil, *paratype* .. | 12.4 | 3.86 | 6.29 | 12.8 | 4.70 |
| ♀, Horqueta, Paraguay, *allotype* ................. | 13.6 | 4.20 | 7.38 | — | — |

In addition to the type and allotype I have before me six males and one adult female, which are considered paratypes, and also two immature females. The data for these specimens are as follows:

Horqueta, Paraguay; August 15 (juv.) and December 21, 1933, January 7, 12 and 16 and February 16, 1934; (A. Schulze); four males, one female, one immature female; [A.N.S.P.].

Cuyabá, Matto Grosso, Brazil; two males; [Hebard Collection].

Chapada, Matto Grosso, Brazil; one immature female; [Carnegie Museum].

The localities here listed show that the species occurs over portions of northern Paraguay and the adjacent State of Matto Grosso, Brazil, to an elevation slightly in excess of two thousand feet (Chapada). The sex correlation is definitely established by the type and allotype having been taken in coitu.

The series shows no noteworthy feature of variation which has not been covered in the above structural and color descriptions.

## BLABERINAE

### HIEREOBLATTA[36] new genus

Related to *Monastria* Saussure,[37] but differing in both sexes in the absence of a distinct tooth or notch from the pronotal margin briefly caudad of the lateral angles, and similarly the virtual absence of the tegminal anal sulcus. The pronotum in both sexes has the lateral angles well rounded, the general form of the whole in the male being semi-ovate, with the caudal margin nearly straight, instead of subpentagonal with the caudal margin subarcuate as in *Monastria*, while in the female the pronotum has its general outline subtriangularly semi-circular, instead of definitely transverse trigonal as in *Monastria*. In *Hiereoblatta* the male has abbreviate coriaceous tegmina, not reaching distad of the middle of the abdomen, with little evident venation, the wings vestigial and non-functional, while that sex of *Monastria* has very ample tegmina and wings, both much surpassing the abdominal apex, with strongly indicated and complex tegminal venation.

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[36] From ιερεύς, *a priest*, and *Blatta*, in allusion to the cowl-like pronotum.

[37] Rev. et Mag. de Zool., (2), XVI, p. 349, (1864). Genotype (by monotypy): *M. biguttata* (Thunberg).

*Generic Description.*—Form subdepressed, elongate elliptical (♂) or ovate (♀), brevialate. Head completely concealed beneath pronotum, in outline cordiform, eyes well separated in both sexes, interspace subequal to half that between antennal scrobes. Pronotum of ♂ semi-ovate, caudal margin subtruncate with a faint median production, caudo-lateral angles broadly rounded, disk of pronotum tribullate, cephalad a marked supracephalic cucullation, and caudo-laterad paired more prominent ovate bullae, the three elements separated by distinct but shallow impressions, margins narrowly cingulate, intra-marginal areas laterad concavo-excavate, surface in large part multinodose; pronotum of ♀ subtriangularly semicircular, lateral margins cephalad obliquely convergent, cephalic point broadly rounded, caudal margin as in male, caudo-lateral angles more narrowly rounded than in ♂, disk tribullate as in ♂ but much less prominently, and less sharply defined from the subconcave lateral areas, margins more broadly cingulate, surface texture as in male. Tegmina not surpassing middle of abdomen, broad, coriaceous, internal margins overlapping, disto-costal angle broadly rounded; venation not prominent, elements poorly defined, generalized, anal subobsolete except distad, humeral trunk alone clearly indicated. Wings completely hidden beneath tegmina, vestigial, non-functional, in ♂ not more than one-third the tegminal length. Abdomen broad; seventh tergite in both sexes sublamellate laterad, latero-caudal angles acute; ultimate tergite (supra-anal plate) in both sexes transverse, subrectangulate, distal margin angulately incised mesad; ultimate sternite (subgenital plate) in male slightly asymmetrical; cerci short, subdeplanate, blunt acute. Femora without genicular spines; cephalic pair with a distal spine on the lobe of each margin, but otherwise unarmed; median pair unarmed ventrad except for a distal spine on the ventro-caudal margin; caudal pair with both margins completely unarmed; all tibiae compressed, cephalic pair subfossorial, extensor surface of same biseriately spined, of other tibiae triseriate, all spines robust, particularly of the extensor surfaces: caudal tarsi with proximal article slightly shorter than distal, pulvillus of former extending nearly to base as a narrow tongue, second to fourth articles with marked pulvilli; tarsal claws equal in length, strongly falcate; arolia very small, entirely between the bases of the claws.

GENOTYPE: *Blatta cassidea* Eschscholtz.

This genus is an off-shoot of the stock which produced *Monastria,* in some respects superficially resembling certain of the zetoboroid genera of the Panchlorinae, and in others suggesting the perisphaerid *Hormetica* and its allies.

**Hiereoblatta cassidea** (Eschscholtz) (Pl. XVI, figs. 23 and 24.)

1822. *Blatta cassidea* Eschscholtz, Entomographien, p. 87. [♀; Santa Catharina, Brazil.]

1864. *Monastria semialata* Saussure, Mém. Hist. Nat. Mex., III, p. 258. [♀; "South America."]

SANTA CATHARINA: Rio Capivary; 1888; (ex Saussure Collection, labelled "*Monastria semialata* Saussure"); one ♂; [Hebard Cln.].

RIO GRANDE DO SUL: Pelotas; one ♀; [Hebard Cln.].

There is no doubt in my mind as to the correctness of the above synonymy, which was established by Kirby in 1904.[88] The descriptions of the two show no features of difference, and Saussure was apparently unaware of the earlier *cassidea*.

The species is apparently limited to southern Brazil, the only other exact record known being that already given by me from Theresopolis, Santa Catharina, Brazil.

The two specimens before me measure (in millimeters) as follows:

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen | Greatest width of abdomen |
|---|---|---|---|---|---|---|
| ♂, Rio Capivary ... | 52 | 16.8 | 20 | 23 | 14.3 | 23 |
| ♀, Pelotas ........ | 50.8 | 17 | 25.5 | 24.3 | 17 | 26.2 |

## CORYDIINAE

**Latindia pectinata** new species (Pl. XVI, figs. 25 and 26.)

More nearly related to *L. dohrniana* Saussure and Zehntner[89] than to any other species now known referable to the genus. It is a much paler species than *dohrniana*, with material of both sexes of which, from a number of localities, the new species has been compared, differing conspicuously in the regular, subparallel and continuous emphasis of the discoidal, median and ulnar veins of the tegmina, which in the left tegmen reach to the apex with their interspaces of regular width, the rami of the ulnar vein of the same tegmen all on the sutural side, regularly pectinate and numbering nine, these in all cases simple and obliquely subparallel, and like the principal tegminal veins exceptionally direct, clear and sharp for a member of this subfamily. The interspaces between the longitudinal tegminal veins also show much less definite intercalated false nervures than in *L. dohriana*.

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[88] Syn. Catal. Orth., I, p. 162.

[89] Biol. Cent.-Amer., Orth., I, p. 111, pl. 5, fig. 7, (1894), [♀; Guatemala.]

There is apparently no very close relationship to *L. maurella* Stål, the genotype, described from Rio de Janeiro.[40]

*Type.*— ♀ ; Nova Teutonia, Santa Catharina, Brazil. February 21, 1935. (Fritz Plaumann). [Academy of Natural Sciences of Philadelphia, Type no. 5553].

Size small; form moderately deplanate, as usual in the genus; surface of pronotum subshagreenous, brevisetose, exposed section of tegmina subcoriaceous, sparsely brevisetose.

Head with entire width of occiput and adjacent portion of eyes visible cephalad of pronotum from dorsum, in cephalic aspect the head is broad cordiform, subtrigonal, the greatest depth slightly less than the greatest width across eyes, this point faintly dorsad of middle point of eye-depth; occipital outline low arcuate, of the eyes more strongly arcuate; interspace between eyes at occiput very broad, equal to one and one-third times that between internal margins of antennal scrobes and subequal to the separation of the broad ventral sections of the eyes where they incurve on the lower face; surface of eyes with the individual facets very appreciably convex: antennae incomplete: palpi very stout; ultimate article very broad trigonal, oblique subtruncate at distal extremity, this margin equal to three-fifths the length of the straight dorsal line of the article, the greatest depth but slightly less than the distal margin length; penultimate article quite short, in length equal to depth of ultimate, broadly belled infundibuliform.

Pronotum markedly deplanate, transversely short ovate, flattened caudad, greatest median depth contained one and four-tenth times in the greatest pronotal width, which is faintly caudad of the median transverse axis of the pronotum: cephalic margin quite arcuate, passing laterad without a delimiting angle into the more moderately arcuate, somewhat caudad divergent lateral margins, which more strongly arcuate caudad broadly round into the transverse truncate caudal margin: in addition to the shagreenous and brevisetose character of the surface, the disk carries the Y-shaped sulcation found in the species of the genus, the cephalic paired arms very strongly divergent and reaching to the lateral borders of the disk, while caudad the shaft of the sulcation briefly fails to reach the caudal margin, the supra-cephalic, prediscal section of the pronotum briefly transverse subconcave.

Tegmina elongate elliptical, surpassing apex of abdomen by a distance about equal to one and one-half times the pronotal length, greatest tegminal width contained one and two-fifth times in greatest tegminal length: costal margin nearly straight mesad, slightly oblique subarcuate proximad, in distal third broadly arcuate to the rather narrowly rounded apex; sutural margin moderately arcuate throughout, but somewhat flattened mesad: marginal field very narrow, of subequal width, distinctly concave canaliculate longitudinally; scapular field somewhat broader than marginal, not concave; anal field small but distinct, occupying but slightly more than a fourth the tegminal length, its greatest width faintly less than half the length of the field, in outline quite slender and elongate pyriform: costal veins ten in number, oblique, those nearest the mediastine vein more closely placed than those distad, which latter are quite widely spaced; discoidal vein pronounced, subarcuate proximad; median and ulnar veins in the separate positions found in this genus, regular, subparallel, except for very faint expansion of the interspaces between these elements and the discoidal vein briefly before the middle of the tegmen; arcuate pectinate rami of the ulnar vein extending obliquely toward sutural margin, as a whole evenly disposed, in the left (normally exposed) tegmen with eight clearly defined, the same number present in the normally covered subhyaline area of the right tegmen but the more proximal ones are far more strongly arcuate, in fact falcate, and more widely spaced, each diverging from the ulnar vein (where definitely traceable) more definitely distad than on left tegmen and reaching sutural margin at a point less definitely distad, the distal two-fifths of the ulnar vein in the right tegmen not evenly paralleling the median vein but distinctly flexed toward the sutural margin; anal sulcus distinct; intimations of three axillary veins definitely traceable; areolets of the discoidal field of the normally exposed left tegmen in general subquadrate, occasionally rectangulate. Wings with lobation of radiate field sharply cut off from anterior field; ulnar vein with five distinct oblique arcuate rami; at least three costal veins indicated.

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[40] Kongl. Svenska Fregat. Eugenies Resa, Zool., I, Ins., p. 312, pl. 5, figs. 3-3a, (1860), [♂].

Ultimate tergite (supra-anal plate) semicircular, mesad with a quite narrow and deep U-shaped emargination, the marginal angles bounding the same sharp and subacute: ultimate sternite (subgenital plate) subvalvate, the produced medio-distal portion mesad not divided but clearly defined by sculpture from the relatively short, transverse, more proximal portion of the sternite, the medio-distal portion marginally arcuate with a definite but brief median V-emargination giving additional valvate appearance to the sternite: cerci very slender fusiform, very acute at apex, nine-segmented, the distal one very slender and aciculate, cercal length equal to one and two-third times that of ultimate sternite.

Femora stout, compressed, unarmed beneath: remainder of limbs damaged.

General color tone tawny-olive, slightly washed with ochraceous-tawny on much of pronotal disk and brushed narrowly along the tegminal mediastine vein with fuscous, head slightly more rufescent than general color, abdomen obscurely washed with fuscous, limbs nearer clay color.

Length of body, 5.12 mm.; length of pronotum, 1.51; greatest width of pronotum, 2.14; length of tegmen, 5.58; greatest width of tegmen, 1.93.

The type of this species is unique.

**Ceuthobia fratercula** new species

Closely related to *Melestora fulvella* Rehn,[41] from the Misiones, Argentina, which in 1921 was referred to his new genus *Ceuthobia* by Hebard.[42] Both *fulvella* and *fratercula* are not typical *Ceuthobia*, approaching *Ceuthobiella* Hebard[43] in the inconspicuous ocelli, the non-clavate costal veins and subobsolete intercalated triangle of the wings, and future work with larger and more representative series may require a different generic assignment. The present reference of these two species to *Ceuthobia* is purely tentative.

From *fulvella*, the type of which is before me, *fratercula* differs in its appreciably smaller size, its more definitely cordiform and less transverse head, and stockier and more robust limbs.

*Type.*—♂; Villa Rica, Paraguay. February, 1922. (Pedro Jorgensen). [Academy of Natural Sciences of Philadelphia, Type no. 5552].

Size very small: form elongate elliptical: surface moderately polished, tegmina subcoriaceous with numerous subrecumbent setae.

Head but narrowly visible cephalad of the pronotum when seen from the dorsum, in cephalic aspect cordiform in outline, the greatest width across the eyes subequal to the head depth, the greatest width placed slightly dorsad of the transverse median axis of the head; occipital outline moderately arcuate, continuing the curvature of the outline of the not at all protuberant eyes; interspace between eyes one-fifth broader than that between the internal margins of the antennal scrobes; face moderately arcuate in transverse section; eyes with the individual facets moderately differentiated in surface convexity: antennae in an incomplete condition as long as the body, articles moniliform, moderately but regularly individually increasing in length distad from the third, progressively brevisetose, proximal article relatively stout, in length subequal to half the distance between the internal margins of the antennal scrobes: palpi damaged.

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[41] Proc. Acad. Nat. Sci. Phila., 1913, p. 283, fig. 3, (1913), [♂].

[42] Proc. Acad. Nat. Sci. Phila., 1921, p. 295, (1921).

[43] Proc. Acad. Nat. Sci. Phila., 1921, p. 246, (1921).

Pronotum with greatest width subequal to one and two-fifth times its greatest length, transversely subtrapezoidal; cephalic margin low arcuate, its width subequal to five-elevenths of the greatest width, rounding laterad into the obliquely divergent gently arcuate lateral margins, which in turn rather broadly round over the latero-caudal angles, which are placed briefly caudad of the transverse center of the pronotum, into the broadly arcuate caudal margin, which is not definitely divided into a main caudal and latero-caudal sections: margins as a whole narrowly cingulate: surface subdeplanate on disk, relatively narrow lateral areas rather sharply deflexed, marked paired broad discal impressions diverging latero-cephalad from a point about one-third the pronotal length from the caudal margin, well separated caudad and failing to reach the margin latero-cephalad.

Tegmina elongate and narrow elliptical, their greatest length contained three and two-fifth times in their length, apices surpassing the apex of the abdomen by a distance equal to the length of the pronotum: costal margin arcuate, slightly less markedly so mesad; sutural margin similarly arcuate, apex rather narrowly rounded: marginal field relatively narrow, definitely delimited by the faintly sinuate mediastine vein; scapular field somewhat broader than the marginal; anal field acute subpyriform, occupying slightly more than one-third the total tegminal length, the greatest width of the field faintly less than half its length: costal veins six clearly definite, strongly oblique, slightly arcuate, regularly spaced; discoidal sectors virtually longitudinal, four in number, the cross-veins few, areolets large and relatively few, usually elongate rectangles; anal sulcus marked, its proximal half moderately arcuate, the distal half straight oblique except for a short arcuation preceding its junction with the sutural margin; axillary veins four in number, subparallel, converging and fusing distad, their interspaces rectangulate where definitely defined. Wings fully developed, reaching to the tegminal apices; costal veins nine in number, the more proximal five somewhat thickened, but not at all clavate, regularly spaced; intercalated triangle very much reduced, extending proximal not over a fifteenth of the wing length; medio-discoidal interspace at least three times as wide as the medio-ulnar.

Abdomen with the dorsal surface distinctly concave: ultimate tergite (supra-anal plate) transverse, its greatest median length contained slightly more than two and one-half times in the greatest proximal width of the tergite, distal margin uniformly and strongly arcuate, its dorsal surface with three low rounded bosses, one median, the others paired laterad over cercal bases: ultimate sternite (subgenital plate)[44] transverse subtrigonal, its distal margin straight oblique on dextral side, largely concave on sinistral side; dextral style distal in position on sternite, short, broad, bifid, one point being an aciculate curved spine, the other bearing a group of five or more stout chaetae; sinistral style very short, stout conical, simple, with a few apical elongate chaetae: cerci broken.

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[44] Described from paratype, this area in male type is not clearly visible.

Limbs incomplete in type (and paratype), moderately robust as preserved.

General color tone dresden brown, occasionally darkened mesad on the pronotal disk by a wash of mummy brown (paratype) and paling to light clay color on the limbs. Head prout's brown, eyes blackish fuscous, palpi and antennae slightly darker than the general tone. Venter of abdomen clay color proximad, darkening distad to prout's brown.

Length of body, 4.66 mm.; length of pronotum, 1.17; greatest width of pronotum, 1.63; length of tegmen, 5.41; greatest width of tegmen, 1.59.

In addition to the type I have before me, from the Academy collection, a single paratypic male taken at Trinidad, Paraguay, January 3, 1920, by Pedro Jorgensen. Except as remarked above, this specimen shows no noteworthy difference from the type.

## PERISPHAERINAE

### SIBYLLOBLATTA[45] new genus

A member of the endemic neotropical Brachycolae, with all the valid genera of which it has been compared,[46] but differing very definitely by combinations of characters, although as a whole nearer *Parahormetica* than any other member of the group. From all these genera the present entity differs in possessing distinct intra-marginal foramenoid pores laterad on the pronotum, such as are found in a number of Old World genera of other groups of the subfamily. With *Parahormetica* the genus *Sibylloblatta* agrees in possessing lateral, sublobiform tegmina, definite but lobiform, non-functional and normally covered corneous wings and in the proximal article of the caudal tarsus having the pulvillus extending not more than half-way to the base. From *Parahormetica*, however, it differs in having the pronotum cingulate caudad, in lacking any ventral marginal femoral spines and having but one (instead of two) distal spine on the ventro-caudal margin of the cephalic and median femora, in the subequally long proximal and distal caudal tarsal articles, while very prominent arolia are present between the tarsal claws, instead of these being obsolete as in *Parahormetica*.

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[45] From *Sibylla*, a prophetess, and *Blatta*.

[46] I. e. *Hormetica* Burmeister, *Parahormetica* Brunner, *Brachycola* Serville, *Styphon* Rehn, and *Bion* here described.

From *Hormetica*[47] certain other features distinguish the new genus, such as the lateral, non-attingent tegmina, and the pulvillus of the proximal article of the caudal tarsi not longer than half the article. From *Brachycola* the reduced alar organs, the presence of certain distal femoral spines and the shorter pulvillus of the proximal article of the caudal tarsi (equal to one-half instead of two-thirds the length of the article) will readily distinguish *Sibylloblatta.* From the very different *Styphon*[48] the new genus can at once be distinguished by the large arolia, which are obsolete in the previously described genus, the equal length of the proximal and distal caudal tarsal articles, the unspined ventro-cephalic margin of the cephalic femora, the cingulate caudal margin of the pronotum and the unequal, instead of equal, length of the proximal and third articles of the antennae.

*Generic Features.*—Form ovate, subdepressed, lobialate; surface moderately polished. Head hidden under pronotum, broad cordiform in outline, depth and greatest breadth subequal; occipital interspace between eyes broad, surpassing that between internal margins of antennal scrobes: antennae with third article not surpassing half the length of proximal one: palpi short, robust, ultimate and antepenultimate subequal in length, former subsecuriform, penultimate shorter and infundibuliform. Pronotum semi-ovate, lateral and cephalic margins continuously arcuate, caudal margin transverse truncate, caudo-lateral angles rectangulate: surface of disk with very low paired excrescences of hormeticoid type, pale median areas of disk sparsely impresso-punctate; supra-cephalic cucullation not sharply defined; lateral borders strongly reflexed cingulate, immediately cephalad very narrowly and much less strongly bordered, caudal margin mesad distinctly but deplanately and not sharply cingulate, laterad the cingulum is obsolete to caudo-lateral angles; surface of intra-marginal lateral gutters strongly concavo-excavate, supplied with seven to nine spaced and deeply perforate pores, apparently of glandular character. Tegmina lobiform, lateral, subtrigonal, reaching only to basal half of second abdominal tergite, separated mesad by a distance equal to half of tegminal width, corneous, lacking all venation. Wings lateral, lobiform, smaller than and hidden under tegmina but reaching to apices of latter. Limbs robust, cephalic pair subfossorial. Genicular spine present on median and caudal femora, all ventral margins of femora unspined except for single distal spines on the genicular lobes on both margins of the cephalic and on the ventro-caudal of the median pair; all tibiae with extensor surface spines triseriate, median and caudal pairs compressed; caudal tarsi with proximal and distal articles subequal in length, pulvillus of former with a tongue but not reaching proximad of middle of article; arolia fully developed; tarsal claws equal in length, margins unspecialized.

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[47] The genus *Hormetica* is here interpreted in the broad sense required to include the diverse species which have been assigned to it by authors. On the basis of *H. laevigata* Burmeister, the selected genotype, the genus will require narrowing down by splitting off generically certain clearly discordant and distinctive species. I hope in the near future to be able to give this problem the attention it deserves.

[48] Trans. Amer. Entom. Soc., LVI, p. 62, pl. 4, figs. 14-16, pl. 5, figs. 6 and 7, (1930). Genotype: *S. bakeri* Rehn [Bonaire, Curacao and Aruba, Dutch Leeward Islands].

GENOTYPE: *Polyzosteria panesthoides* Walker.

This genus has the most northerly distribution of any of the various components of the Hormeticae, and is the only one known from the Antillean area.[49] Its presence in Jamaica is doubtless due to the previous connection of that island with continental tropical America. The comparative antiquity of the contact which permitted the incursion of the ancestors of *Sibylloblatta*, would naturally be logical to assume, as the whole group is at present, as far as known, unrepresented north of Colombia, in the intervening Central American land. Assuming that the axis of the Antillean land-bridge was along the line generally conceded, i.e. eastward from the present eastern Honduranian uplifts, the avenue of communication, if through Central America, has been broken to the southward according to Schuchert [50] for long periods in the middle of Cenozoic, when the Honduranian Jamaican land-bridge is considered to have been existent. Presumably the Hormeticae entered Jamaica before at least the last of these Central American submergences, and altered conditions subsequently may have removed the group from the Central American landscape, while it continued to exist and continue its evolution in isolated Jamaica.

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[49] The genus *Styphon* (vide supra) and the peculiar species *Hormetica pustulosa* Hebard (Trans. Amer. Entom. Soc., LV, p. 385, pl. 14, fig. 10, (1929), [♂; Bonaire Island] ) are known from the Dutch Leeward Islands, which are generally referred to as part of the Dutch West Indies, following the political alignment. These islands, however, are merely detached parts of the South American continent, and are in no way Antillean. In consequence the statement made above is correct in a physiographic and geological sense.

[50] Historical Geology of the Antillean-Caribbean Region. By Charles Schuchert. 1935.

**Sibylloblatta panesthoides (Walker)** (Pl. XVII, figs. 27 and 28.)

1868. *Polyzosteria panesthoides* Walker, Cat. Spec. Blatt. Brit. Mus., p. 164. [♂; Jamaica.]

1900. *Hormetica advena* Scudder, Proc. Davenp. Acad. Nat. Sci., VIII, p. 94. [♀; (adventive at) Belmont, Massachusetts.]

JAMAICA: At Boston quarantine in bananas from Jamaica; November, 1931; one female; [U.S.N.M.].

This species is one which the author and Mr. Hebard have been endeavoring to secure, or at least examine, for a number of years. In 1927 in our study of the Blattidae of the West Indies[51] we were unable to place the name generically, having no material answering the original description, which was inconclusive as to generic relationship, but were able to give some comments on the type in the British Museum of Natural History furnished by Dr. Uvarov. We could do no more regarding the affinity of the species than quote from Uvarov that it belonged "somewhere near *Hormetica*", and had "the elytra rudimentary like in *Parahormetica* and well developed pulvilli (i. e., arolia) between the claws". The opportunity to examine the present specimen enables me to clear up the situation, and also to establish the synonymy of Scudder's *advena*, which is clearly based on an adventive specimen, probably brought in in bananas, as was the present individual. At the time Scudder's species was described Jamaica was, and had been for some years, the chief source of bananas brought to the United States, and there is every reason to suppose that the type of *advena* came from that island.

The genus *Sibylloblatta*, as represented by *S. panesthoides*, is so distinctive there is little chance of confusing it with any of its relatives. The illustration here presented should permit of its ready recognition.

The specimen now in hand measures as follows: length of body, 41.5 mm.; length of pronotum, 11.6; greatest width of pronotum, 17; length of tegmen, 9; greatest width of tegmen, 8.2; greatest width of abdomen, 20.5.

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[51] Bull. Amer. Mus. Nat. Hist., LIV, p. 317.

### BION[52] new genus

Occupying a position intermediate between *Hormetica* Burmeister[53] and *Parahormetica* Brunner,[54] having affinities with each, but nearer *Parahormetica.* It agrees more nearly with the latter in the general form of the pronotal strumosity, in the tegmina failing to overlap or be attingent mesad, and in the arolia being very small. The genus *Bion*, however, is distinct from all the other known genera of the hormeticoid group in the heavily and deeply shagreened surface of the ovate tegmina, these latter also lacking any trace of venation except a weakly indicated humeral trunk proximad, and in the heavily and solidly rugose character of the very flat dorsal surface of the abdomen.

The genus is much less closely related to *Brachycola* Serville than it is to either of the genera above mentioned.

*Generic Description.*—Form hormeticoid, brevialate; surface largely cribroso-shagreenous. Head hidden beneath pronotum, deplanate, eyes very widely separated (in male); antennae robust, relatively short; palpi short, stout, ultimate article securiform, penultimate short infundibuliform. Pronotum strongly and strumosely binodose, the horse-shoe shaped area between and enclosed by a caudad encircling carination biconcavely subexcavate, as in *Hormetica,* the supra-cephalic margin of the pronotum strongly recurved and labiato-cingulate, all the remainder of the pronotal margin more narrowly cingulate to subcingulate. Tegmina subcircular, reaching only to first abdominal tergite, not attingent mesad, strongly coriaceous and entirely deeply cribroso-shagreenous, lacking virtually all venation except a weakly indicated humeral trunk proximad. Wings rudimentary, not evident. Surface of dorsum of abdomen deplanate, except on three smoother distal tergites strongly and irregularly impresso-rugose; surface of venter of abdomen relatively smooth, paucipunctate, weakly polished. Limbs very stout, relatively short: cephalic coxae inflated: median and caudal femora each with paired distal and a genicular spine, except caudal pair which lack the disto-caudal; cephalic femora having ventro-cephalic margin solely with two median spines, others unarmed: cephalic tibiae very short, stout, fossorial, strongly and triseriately spines on extensor surface; median and caudal tibiae compressed, triseriately spined on extensor surface: caudal tarsi with proximal and distal articles subequal in length, arolia present but small; tarsal claws equal in length, margins simple.

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[52] βιων, a Spartan officer under Thibron.

[53] Handb. der Entom., II, abth, II, pt. 1, p. 511, (1838). Genotype (by indication of Kirby, 1904): *H. laevigata* Burm.

[54] Nouv. Syst. Blatt., p. 385, (1865). Genotype (by indication of Kirby, 1904): *B. tumulosa* Brunner=*Brachycola bilobata* Saussure.

GENOTYPE: *B. mastrucatus* new species.

There is every probability that Saussure's *Brachycola diabolus*[55] is a member of this genus, and is closely related to the species here described.

**Bion mastrucatus**[56] new species

(Pls. XIV, fig. 18; XV, fig. 22; XVII, fig. 29.)

When compared with the descriptions of Saussure's *Brachycola diabolus*,[57] which as stated above is almost certainly congeneric, *mastrucatus* is seen to differ in its broader and more transverse pronotum, this being described in *diabolus* as " assez allongé, parabolique ", in the bicolored pronotum, in the absence of red from all of the abdominal tergites except for very narrow, rather inconspicuous lateral borders, and in the ochraceous, instead of black, ultimate and penultimate abdominal tergites.

*Type.*— ♂ ; Serra do Itaculumy, State of São Paulo, Brazil. April, 1919. (P. da Fonseca). [Museu Paulista].

Size above average: general form depressed, sub-elliptical in outline as seen from dorsum: dorsal surface in large part strongly impressed cribroso-punctate to criboso-rugose, ventral surface subglabrose to glabrose.

Head when seen in cephalic aspect very broad ovoid, its greatest width across eyes equal to seven-eighths the greatest depth of head, face broadly but not at all sharply deplanate, sparsely impresso-punctate, evenly passing dorsad into the very broad interocular region, which is equal to seven-tenths the entire width of head across eyes, while seen in cephalic aspect the occipital line is strongly arcuate, continuing the curvature of the outline of the relatively small and not at all conspicuous eyes: palpi with ultimate article one and two-thirds the length of the penultimate: antennae with third article five-eighths the length of the proximal one, second half the length of the proximal.

Pronotum having the median length faintly less than three-fourths the greatest breadth, which is at four-fifths of its length, general arcuation of latero-cephalic portions of the margin, as seen from dorsum, evenly converging to the supra-cephalic cucullation, where the dorsal recurving, thickening, and labiation of the margin appreciably interrupts its broadly arcuate uniformity, those sections of this margin laterad of the supra-cephalic cucullation not elevated dorsad of the adjacent intro-marginal sections of the surface although narrowly marked off by sculpture; caudo-lateral angles (at point of greatest width) slightly more obtuse than right angles, very narrowly rounded; caudal margin broadly and weakly arcuate, passing laterad into the brief and little differentiated latero-caudal sections, which, however, are obliquely declivent ventro-laterad and subconcave when seen in caudal aspect, the whole caudal section of the margin between the latero-caudal angles moderately thickened and cingulate, largely impunctate and well differentiated from the cribroso-punctate surface of the pronotum peripheral to the disk: horse-shoe shaped discal structure broader than long, at its widest point equal to two-thirds the greatest width of the pronotum, its elements consisting of a latero-cephalic pair of elevated, smoothly but not glabrously rounded, large boss-like tubercles, the centers of which are separated by a distance slightly greater than half the pronotal width, the tubercles connected caudad by a subcarinate and arcuate (and mesad subtruncate) but low rim, bordering the discal area caudad, and mesad in contact with the caudal margin of the pronotum, from which it is separated by a narrow sulcation, the surface of the disk thus bounded by the tubercles and the caudal rim subglabrous, and transversely biconcave, the axis of one concavity briefly caudad to that of the tubercles, a low transverse surface divide between the latter crossed by several small low welt-like longitudinal ridges, while cephalad the smooth surface slopes downward to and concavely passes into the heavily cribroso-punctate supra-cephalic cucullation, the dorsal surface of which is also in part medio-longitudinally carinulate: surface of all the lateral and cephalic (i.e. chiefly supra-cephalic cucullation) areas heavily cribroso-punctate, this coarser laterad than cephalad: ventral surface of lateral portions of pronotum glabrous, with usual position of typical carinae indicated by surface contour but no true carinae are present, a low blunt obliquely truncate, non-projecting node indicating the usual position of the caudal tooth of the carinae.

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[55] Rev. et Mag. de Zool., (2), XVI, p. 345, (1864), [ [ ♂ ]; Brazil.]

[56] I. e. clothed in skins—in allusion to the leathery surface texture of the dorsum.

[57] In addition to the reference given in footnote 55, see the following additional information on this species: Saussure, Mém. Hist. Nat. Mex., III, p. 182, (1864): Saussure, Miss. Scient. Mex., Rech. Zool., VI, p. 99, (1870).

Tegmina subcircular, separated mesad by a distance equal to approximately one-twelfth the width of a single tegmen, greatest length of tegmina slightly less than median length of pronotum: costal margin strongly arcuate, faintly flattened mesad, evenly passing to the equally arcuate distal margin, which more sharply curves disto-suturad to the less strongly arcuate sutural margin: marginal field broad, almost equal in width to a third of the entire tegmen, its dorsal surface appreciably concave, in contrast to the plane or slightly convex character of the remainder of the same surface: humeral trunk represented by a cicatriform ridge, definite only proximad, in the usual area of the anal field an oblique and regular disposition of the narrow " lands " separating the cribrose punctae suggests a venational background; surface of entire tegmina, except for the humeral trunk and the distinctly cingulate costal margin, deeply impressed cribroso-punctate, these so large in the anal area as to constitute impressed areolae of more regular oblique disposition than elsewhere. Wings rudimentary, present but hidden beneath tegmina.

Abdomen with disto-lateral angles of tergites two to six slightly acute-produced caudad, of tergite seven rectangulate, this angle of tergite eight spiraculigerous, briefly exserted, tergites nine and ten invaginated, caudal margins of tergites one to three progressively less definitely convex, of four transverse subtruncate, of five to eight progressively concave; surface of tergites two to seven strongly coarsely and irregularly eroso-shagreenous, to strongly rugose: ultimate tergite (supra-anal plate) with median length slightly less than half greatest proximal width, in shape subtrapezoidal, lateral portions of margin subsigmoidally converging distad and broadly passing into the shallowly but broadly bisarcuate distal margin,[58] surface of tergite with a transverse, nearly straight impression extending between the cercal bases, a shallow medio-longitudinal sulcation present in distal half of tergite, extending to the median marginal emargination. Cerci in type drawn under ultimate tergite and form not clearly evident. Venter of abdomen smooth, sparsely impresso-punctate laterad on the six more proximal sternites, disto-lateral angles of same ranging from rounded rectangulate proximad to arcuato-obtuse-angulate distad: ultimate sternite (subgenital plate) subtrigonal, slightly asymmetrical, its exposed median length equal to approximately three-fourths the greatest proximal width, apex well rounded; dextral stylar socket shallowly but rather lengthily concave along margin, that style quite small, short and simple; sinistral stylar socket in relatively the same position marginally on the sinistral side, much less evident and extensive, not concavely modifying the outline of the sternite, sinistral style missing in type.

Limbs robust, very short, as a whole glabrous: cephalic coxae strongly inflated, ventral surface subtumescent; cephalic femora deep, subcompressed, ventro-cephalic margin mesad with two very short, stout, closely placed spines, distal spine of same margin very short, ventro-caudal margin of cephalic femora with or without a preapical spine of length equal to the distal spine of the same margin, which is longer than that of the ventro-cephalic; cephalic tibiae very short, equal to seven-tenths the femoral length, broad, fossorial, its distal spurs and extensor surface spines heavy, latter triseriate, all very stout at their bases: median coxae stout and sub-bulbous, but less inflated than cephalic pair; median femora compressed, deep, subarcuate, dorsal outline similarly but more strongly arcuate than in cephalic limbs, distal spines of both margins small, ventro-caudal margin with a single preapical spine slightly longer than the distal; median tibiae six-sevenths as long as the femora, very robust, subquadrate in section, compressed, extensor surface with spines triseriate, with the distal spines all robust: caudal femora similar to but larger than median femora, distal spine on ventro-caudal margin lacking, a preapical spine present on the same margin but removed from the usual position of a distal spine by an interval twice as great as that seen in the median limbs; caudal tibiae slightly longer than the femora, straight, subcompressed, spines of extensor surface subcompressed, exclusive of the distal spines numbering four in each marginal series and five in the median one; caudal tarsi in length equal to three-fifths that of the tibiae, the proximal article in length equal to that of second to fourth articles inclusive, regularly enlarging distad, pulvillus reaching proximad in an acutely pointed extension to more than half-way to the base of the article, second to fourth articles each very short and with circular or subcircular pulvilli, distal article subequal to proximal in length, arolium relatively small but well indicated, tarsal claws equal in length, strongly falcate, internal margin of same simple except for a proximal obtuse shoulder.

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[58] The distal section of the tergite has distinctly decurved in drying, and the bisarcuate character of this margin may have been accentuated by this condition. However, I have no definite evidence that what is seen is not the normal outline.

General base color pitch brown, relatively dull dorsad on account of the shagreenous character of most of that surface, venter of abdomen shining. Pronotum with the intertubercular discal pattern and narrow intro-marginal lateral crescents ranging from auburn to orange rufous, paler caudad on the crescents and meso-caudad on the disk, the cephalic border of the discal paler area extending into the pitch brown section in two diverging, broad subfalcate lobules. Tegmina of base color, passing to dull madder brown in marginal field. Exposed narrow inter-tegminal sections of the meso- and metanota liver brown, each crossed by a narrow wavering band of zinc orange. Dorsum of abdomen with tergites narrowly bordered with madder brown, ultimate tergite (supra-anal plate) largely dull zinc orange. Head liver brown with four paired dots of vinaceous-rufous placed immediately mesad of antennal scrobes and at proximo-lateral angles of clypeus; eyes hair brown; palpi and antennae of general color. Ventral surface of pronotum with broader crescents of zinc orange to vinaceous-rufous, paler caudad and there intro-marginal, cephalad becoming marginal and reaching to the supra-cephalic cucullation. Abdominal venter solidly of the general color. Limbs, including coxae, as a whole ranging from vinaceous-rufous to mahogany red, palest on the coxae and darkening progressively to the tibiae, the tarsi except the paler pulvilli, pitch brown, tibial spines and spurs of color of tibiae proximad, becoming pitch brown distad.

Length of body, 35.5 mm.; length of pronotum, 12; greatest width of pronotum, 16.9; length of tegmen, 10.5; greatest width of tegmen, 10.5; greatest width of abdomen, 19; length of caudal tibia, 11.

The type of this most distinctive species of a previously unrecognized genus is unique.

## EXPLANATION OF PLATES

### PLATE XIV

Fig. 1.—*Cahita nahua* (Saussure). Lateral view of palpus of male. Cantarranas, Honduras. (Greatly enlarged.)

Fig. 2.—*Cahita nahua* (Saussure). Dorsal view of ultimate tergite (supra-anal plate) of male. Cantarranas, Honduras. (Greatly enlarged.)

Fig. 3.—*Cahita nahua* (Saussure). Ventral view of ultimate sternite (subgenital plate) of male. Cantarranas, Honduras. (Greatly enlarged.)

Fig. 4.—*Cahita misella* new species. Ventral view of ultimate sternite (subgenital plate) of male (*type*). Roxborough, Tobago, West Indies. (Greatly enlarged.)

Fig. 5.—*Cahita hystrix* new species. Lateral view of palpus of male (*type*). Teffe, Amazonas, Brazil. (Greatly enlarged.)

Fig. 6.—*Cahita hystrix* new species. Dorsal view of ultimate tergite (supra-anal plate) of male (*type*). Teffe, Amazonas, Brazil. (Greatly enlarged.)

Fig. 7.—*Cahita hystrix* new species. Ventral view of ultimate sternite (subgenital plate) of male (*type*). Teffe, Amazonas, Brazil. (Greatly enlarged.)

Fig. 8.—*Cahita borero* new species. Dorsal view of ultimate tergite (supra-anal plate) of male (*type*). Descalvados, Matto Grosso, Brazil. (Greatly enlarged.)

Fig. 9.—*Cahita borero* new species. Ventral view of ultimate sternite (subgenital plate) of male (*type*). Descalvados, Matto Grosso, Brazil. (Greatly enlarged.)

Fig. 10.—*Cahita borero* new species. Lateral outline of ultimate sternite (subgenital plate) of male (*type*), showing median tooth series. Descalvados, Matto Grosso, Brazil. (Greatly enlarged.)

Fig. 11.—*Cahita borero* new species. Cephalic femur of male (*type*), showing spination of ventro-cephalic margin. Descalvados, Matto Grosso, Brazil. (Greatly enlarged.)

Fig. 12.—*Cahita borero* new species. Tarsal claws and arolium of male (*type*). Descalvados, Matto Grosso, Brazil. (Greatly enlarged.)

Fig. 13.—*Cahita linguata* new species. Dorsal view of ultimate tergite (supra-anal plate) of male (*type*). Chapada, Matto Grosso, Brazil. (Greatly enlarged.)

Fig. 14.—*Cahita linguata* new species. Ventral view of ultimate sternite (subgenital plate) of male (*type*). Chapada, Matto Grosso, Brazil. (Greatly enlarged.)

Fig. 15.—*Phortioccoides guarani* new genus and species. Dorsal view of male (*type*). Horqueta, Paraguay. (× 3.)

Fig. 16.—*Phortioecoides guarani* new genus and species. Proximal section of antenna of male (*type*). Horqueta, Paraguay. (Greatly enlarged.)

Fig. 17.—*Phortioecoides guarani* new genus and species. Dorsal view female (*allotype*). Horqueta, Paraguay. (× 2.)

Fig. 18.—*Bion mastrucatus* new genus and species. Ventral view of ultimate sternite (subgenital plate) of male (*type*). Serra do Itaculumy, São Paulo, Brazil. (× 4.)

## PLATE XV

Fig. 19.—*Eurycotis histrio* new species. Dorsal view of male (*type*). Northeastern foothills of the Massif la Hotte, Haiti, Hispaniola. (× 3.)

Fig. 20.—*Eurycotis histrio* new species. Lateral view of head, thorax and left tegmen of male (*type*). Northeastern foothills of the Massif la Hotte, Haiti, Hispaniola. (× 3⅓.)

Fig. 21.—*Dryadoblatta mira* new species. Dorsal view of male (*type*). Mt. Duida, Venezuela, (× 2.)

Fig. 22.—*Bion mastrucatus* new genus and species. Ventral view of apex of abdomen of male (*type*). Serra do Itaculumy, São Paulo, Brazil. (× 3.)

## PLATE XVI

Fig. 23.—*Hiereoblatta cassidea* (Eschscholtz). Dorsal view of male, Rio Capivary, Santa Catharina, Brazil. (× 1⅙.)

Fig. 24.—*Hiereoblatta cassidea* (Eschscholtz). Dorsal view of female. Pelotas, Rio Grande do Sul, Brazil. (× 1⅙.)

Fig. 25.—*Latindia pectinata* new species. Pronotum of female (*type*). Nova Teutonia, Santa Catharina, Brazil. (Greatly enlarged.)

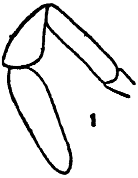
Fig. 26.—*Latindia pectinata* new species. Tegmen of female (*type*). Nova Teutonia, Santa Catharina, Brazil. (× 12.)

## PLATE XVII

Fig. 27.—*Sibylloblatta panesthoides* (Walker). Dorsal view of female. Jamaica. (× 1⅕.)

Fig. 28.—*Sibylloblatta panesthoides* (Walker). Lateral view of pronotum and tegmen of male. Jamaica. (× 3¼.)

Fig. 29.—*Bion mastrucatus* new genus and species. Dorsal view of male (*type*). Serra do Itaculumy, São Paulo, Brazil. (× 1½.)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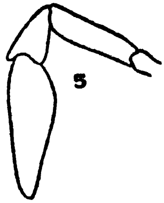
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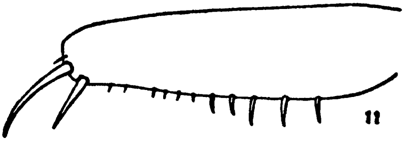
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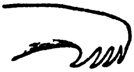
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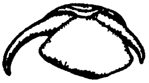
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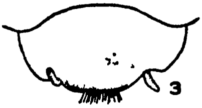
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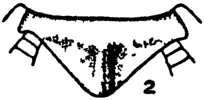
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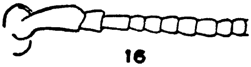
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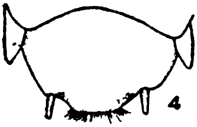
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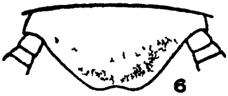
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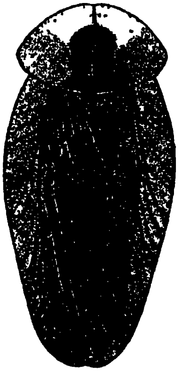
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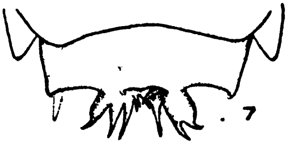
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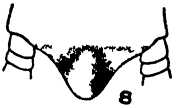
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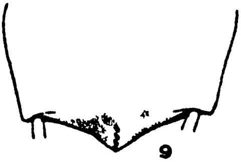
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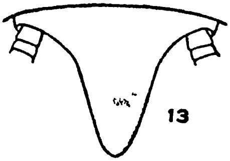
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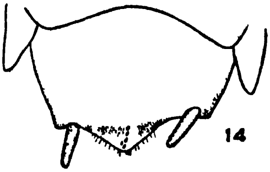
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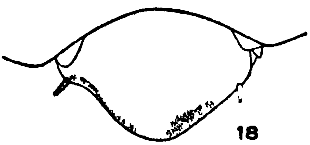
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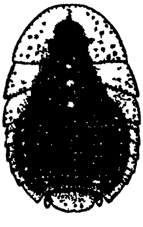
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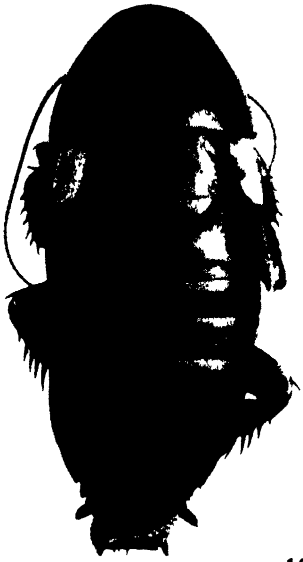
REHN—NEOTROPICAL BLATTIDAE



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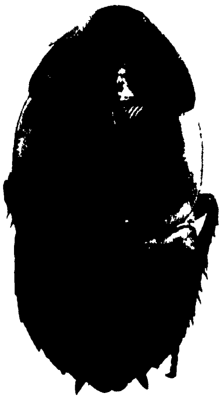

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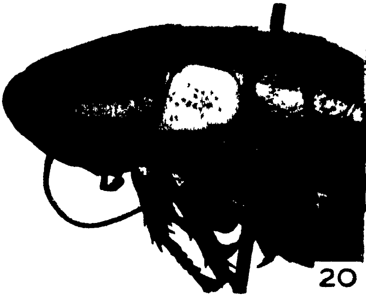

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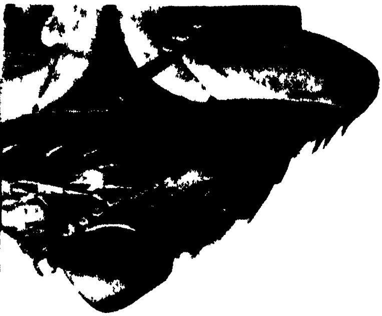

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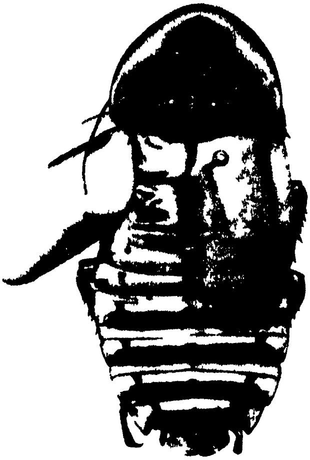

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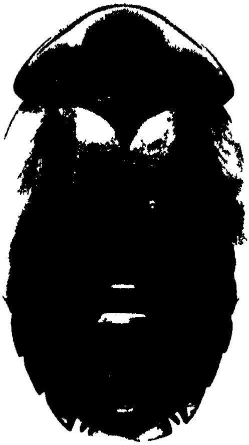

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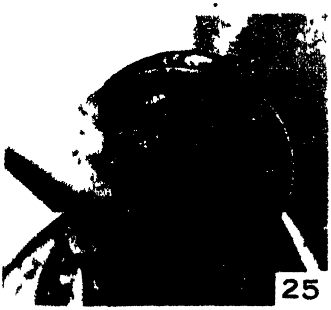

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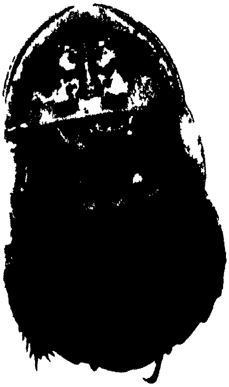
REHN—NEOTROPICAL BLATTIDAE



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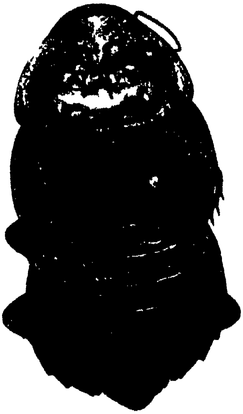

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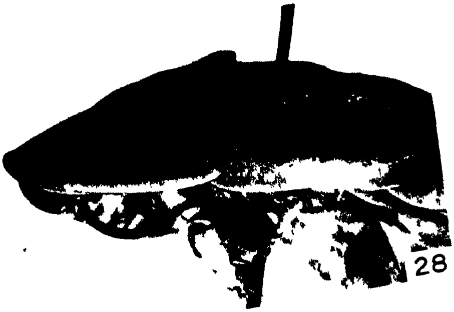

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REHN—NEOTROPICAL BLATTIDAE

# A REVISION OF THE NEARCTIC CEPHIDAE *

## (HYMENOPTERA: TENTHREDINOIDEA)

BY DONALD T. RIES

(Plates XVIII to XX)

## INTRODUCTION

Seven species of Cephidae in North America have attracted the attention of economic entomologists, but little has been published in recent years dealing with the entire North American fauna. Numerous writers have dealt extensively with the palearctic species. It is hoped that this study, which presents a phylogenetic classification of the North American Cephidae will be of interest to both economic and systematic entomologists.

For many years the members of this family have received the attention of hymenopterists of the world. Most of the European workers dealt with their native fauna.

Say [1] was the first American to publish descriptions of new species found in this country. A number of years later, Guerin-Meneville [2] published a description of a Cephid from Mexico. Another twenty years elapsed before Norton [3] published descriptions of other North American Cephidae. Soon afterward Cresson [4] published descriptions of a number of new American species belonging to this family.

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* Since the completion of this manuscript, I have had a preliminary revision of the Nearctic genera of Cephidae appear in Dr. H. H. Ross' "Generic Classification of Nearctic Sawflies." (Ill. Biol. Monogr., xv, pp. 114–116, July, 1937.)

[1] Keating's Narrat. Long's Exped. II, p. 314, (1824).

[2] Iconogr. Regn. Anim., VII, p. 403, n. 3, (1845).

[3] Trans. Amer. Ent. Soc., I, pp. 196–201, (1867).

[4] Trans. Amer. Ent. Soc., VIII, pp. 65–66, (1880).
Trans. Amer. Ent. Soc., XIV, Suppl. Vol., p. 172, (1887).

Kirby[5] in 1882 listed all the described Cephidae of the world and his grouping of the species closely coincides with the generic limits used in this paper. Konow[6] in 1896 published a classification of the Cephini; the same author in 1898[7] gave a key to the "exotic Cephids" (which included North American Species), while in 1904[8] he published a classification of this group which included all the known species of the world.

Ashmead[9] in 1898 published a classification of the sawflies in which he included a key to the genera of the Cephidae, which was, however, largely a repetition of Konow's earlier work.[8] Rohwer[10] in 1911 published a classification of the Chalastogastra in which he mentions this family briefly. A few years later the same author[11] published a paper on the species of *Cephus* in North America.

Benson[12] gives us the most recent classification of the genera of this family for the world.

The members of this family, with the exception of a few species, are not common. Collections throughout the country have comparatively few representatives. Some thirty institutions throughout the United States and Canada were contracted for material, and with the exception of the United States National Museum, Canadian National Collections, and California Academy of Sciences, only a few specimens were received from each. Approximately 3000 specimens have been examined in connection with this revision.

In order to have uniformity throughout, new descriptions have been written of all the species studied. Through the courtesy of the Academy of Natural Sciences of Philadelphia, the Cresson and Norton types, as well as all other types deposited there, were made available for study. Since the Say types have been lost, descriptions of these species have been drawn from topotypical specimens that closely agree with Say's original descriptions.

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[5] List Hym. Brit. Mus., I, pp. 353–364, (1882).

[6] Wien. Ent. Ztg., XV, pp. 150–179, (1896).

[7] Ent. Nachr., XXIV, pp. 72–80, (1898).

[8] Zeit. Hym. u. Dipt., IV, pp. 228–277, (1904).

[9] Can. Ent., XXX, pp. 181–182, (1898).

[10] Proc. Ent. Soc. Wash., XIII, pp. 215–216, (1911).

[11] Proc. Ent. Soc. Wash., XIX, pp. 139–141, (1917).

[12] Ann. and Mag. Nat. Hist., (10), XVI, pp. 335–53, (1935).

I have not examined the Provancher types in the Quebec Provincial Museum nor the Norton types in the Harris Collection of the Boston Society of Natural History, but comparisons with these types have been made for me by Mr. Georges Gauthier, Assistant Provincial Entomologist, and Dr. Richard Dow of the Boston Society of Natural History respectively. The Linnean and Fabrician types have not been seen. The following types of the nearctic Cephidae have not been personally examined: *Phylloecus bicinctus* Provancher, *Cephus integer* Norton, *Cephus heteropterus* Norton, *Cephus filicornis* Harris MS, *Sirex pygmaeus* Linnaeus, and *Sirex tabidus* Fabricius.

Recent authors have divided the Cephidae into many more genera than seems advisable. A number of the characters used for generic separation represent either the extremes or intermediate forms of a single genus. This will result in a number of changes in the classification given by Benson.[12a]

The number of pre-apical spurs on the posterior tibiae have been used by a number of workers in dividing the genera of Cephidae into several large groups. This character has been found to be so variable within the species of some genera that its use is not warranted. Certain genera have been said to possess normally two pre-apical spurs on the posterior tibiae. In studying long series it has been found that the presence of two pre-apical spurs on the posterior tibiae is not constant. This is especially true in *Cephus*. In the original description of *Calameuta*, which now falls as a synonym of *Cephus*, Konow[13] states " tibiae posticae 1 vel 2 spinis superapicalibus praeditae ", but later authors, including Benson,[14] have stated that this genus had but a single pre-apical spur on the posterior tibiae. In examining a large number of the nearctic species, *C. clavatus* (Norton), as well as a limited number of the palearctic species, *C. filiformis* Eversmann, it was found that both of these species may bear a single pre-apical spur on each side, two preapical spurs on each posterior tibia, or, in some cases, one spur on one side and two spurs on the other. Careful examination of these latter individuals failed to disclose that one of the spurs had been broken off on the one side. The same variation was noted in *C. cinctus* Norton and in nearctic specimens of *C. pygmaeus* (Linnaeus) and *C. tabidus* (Fabricius). Mr. Benson, in a personal communication, informed me that he had found a similar variation, although not as high a percentage, in palearctic specimens of these two last named species.

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[12a] Ann. & Mag. Nat. Hist., (10), XVI, pp. 541–548, (1935).

[13] Wien. Ent. Zeit., XV, p. 159, (1896).

[14] Ann. and Mag. Nat. Hist., (10), XVI, p. 544, (1935).

In *Janus*, which normally possesses two pre-apical spurs on the posterior tibiae, one nearctic species, *Janus rufiventris* (Cresson), has but a single pre-apical spur on the posterior tibiae. Despite this difference there is no doubt that it belongs in this genus.

It should be mentioned, however, that this is not always such a variable character. In *Caenocephus* the absence of pre-apical spurs on the posterior tibiae has been a constant character in all specimens examined. In all nearctic species of *Hartigia*, and all palearctic species of *Hartigia* thus far examined, the presence of a single pre-apical spur on the posterior tibiae is constant. A full discussion of the variations will be found under the respective genera.

Another character used previously is the respective lengths of the third and fourth antennal segments. Here again examination of long series shows such a variation that it has been necessary to discard the character.

The dentation of the left mandible, hitherto used in keys to genera, shows that while it may be used in certain groups for determining paths of phylogenetic development, it does not lend itself to use in a key.

Benson[15] also makes use of the tarsal claw. This character has proved to be very constant and useful in defining many genera.

The shape of the antennae also offers reliable characters for the separation of genera in the Cephidae, and has been used in defining genera in this revision. A full discussion of the types of antennae will be found later in this paper.

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[15] Ann. & Mag. Nat. Hist., (10), xvi, pp. 541–548, (1935).

As has been mentioned, a number of the members of the family Cephidae have attracted the attention of economic entomologists. *Cephus cinctus* Norton, *C. pygmaeus* (Linnaeus), and *C. tabidus* (Fabricius) are important pests of grains, especially wheat in this country. *Hartigia trimaculata* (Say) has been recorded from many places boring in the stems of blackberry. *H. cressonii* (Kirby) is reported to be very injurious to both wild and cultivated blackberries, loganberries, raspberries, and roses in California. *Janus abbreviatus* (Say) has been recorded as injuring the growing stems of poplar and willow. *J. integer* (Norton) is one of the best known members of the family through the damage it causes to currant bushes. The immature stages and biology are known for only these of the twelve species discussed in this paper.

## EXPLANATION OF TERMS

The terms used in this paper are chiefly those used by Crampton[16] and Ross.[17] For convenience, the definitions of those most frequently used are repeated here.

On the head the following terms are used: the *postocellar line* (POL) (Fig. 50) extends between the posterior ocelli on the dorsal aspect of the head. The *ocellocular line* (OOL) (Fig. 50) extends between the posterior ocelli and the compound eyes. The *lateral ocellar line* (LOL) (Fig. 50) extends between the posterior and anterior ocelli. The *malar space* (MS) (Fig. 45) is the small area between the base of the mandibles and the lower margin of the compound eye. The *ocellar basin* (OC) (Fig. 45) is the depression in front of the anterior ocellus.

On the thorax the terms used are: the *pronotum* (PR) (Fig. 44) is the large sclerite on the cephalic portion of the thorax. The *praescutum* (PRS) (Fig. 44) is the small triangular sclerite immediately caudad of the pronotum. The *scutum* (ST) (Fig. 44) forms the larger ventral portion of the mesonotum. The scutellum (SCL) (Fig. 44) is the triangular caudal portion of the thorax. The *mesepisternum* is the cephalo-lateral portion of the thorax just below the tegulae.

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[16] Proc. Ent. Soc. Wash., XXI, pp. 129–155, (1919).

The female genitalia or saw has been referred to in some genera and the parts are named in order to avoid confusion. The terms used are those given by Ross.[17] The *sheath* (SH) (Fig. 20) is the posteriorly exserted scabbard-like structure at the caudal end of the female. It is made up of two chitinized plates that form a protective housing for the saw. The saw (LN and LT) (Fig. 20) is composed of four blades, two forming the dorsal half, the *lance* (LN), which is usually equipped with small teeth and fixed firmly at the base. It is also usually divided into segments by *annuli* (AN) (Fig. 29). The ventral half of the saw is called the *lancet* (LT) (Fig. 20) and is equipped with different forms of teeth (Figs. 29, 34, 37, and 40). It is attached to strong muscles within the abdomen, is moved in a saw-like manner backward and forward, and is slotted into the lance which acts as a guide. The ventral edge of the lancet is divided into lobes which are toothed; these lobes correspond closely in position to the segments of the lance, although the annuli are not always present. On the lateral face of the lancet may be a row of wing-like structures, the alae, extending diagonally across the blade. These frequently bear *alar spines* (AS) and *alar spurs* (AR) (Fig. 29).

The male genitalia have been used to some extent in the classification of this family. There is a diversity of form even within some genera. The parts used in this paper are those seen from the ventral aspect.

The *gonocardo* (GO) (Fig. 1) is the crescent-shaped sclerite at the base of the structure. Two large sclerites forming the central portion of the capsule are the *gonostipes* (GS) (Fig. 1). On the apical margin of the gonostipes are borne the *claspers* (CL) (Fig. 1). Two other paired structures appearing to be on the apical margin of the gonostipes and at the base of the claspers are the *volsella* (VA) (Fig. 1) on the outside, and the *sagitta* (SA) (Fig. 1) on the inside. From within the capsule formed by the gonostipes the *penis valves* (PV) (Fig. 1) arise. The two penis valves enclose the membranous penis and are variable in shape in the Cephidae. In *Janus, Hartigia,* and *Caenocephus* they appear to be separated from the base to the tip, but are connected by a thin membrane. In *Cephus* however, the upper portion is fused nearly its entire length (Fig. 1).

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[17] Ill. Biol. Monogr., xii, pp. 8–10, (1929).

In the Cephidae is found a structure termed by Ross[17a] the *median sclerotized style* (MS) (Fig. 1). This is a chitinized rod attached to the upper margin of the gonocardo between the bases of the gonostipes and extends between the gonostipes along the ventral side of the penis valves. An examination of this structure in the different genera of the Cephidae indicates that it has developed from a fold of the membrane between the gonostipes that has become chitinized. In *Janus* the basal attachment is weak and the style is easily removed, and it extends about half way along the penis valve where it becomes thinner and finally disappears in the membrane between the penis valves. In *Caenocephus* it is more firmly attached at the base but its extent and disappearance is similar to that found in *Janus*. In *Hartigia* this structure appears as a very narrow chitinous rod between the gonostipes, but it thins out so that the apices are not determinable. In *Cephus,* however, the median sclerotized style is very well developed and in all neartic species is firmly attached to the margin of the gonocardo, and extending well along the ventral side of the penis valves. In *C. pygmaeus* the rod extends well into the penis valves and appears to be dichotomously branched near the tip to form two distinct fluted lobes. In *C. clavatus* the structure appears to broaden near the apex and fuse with the tip of the penis valve (Fig. 7).

## PHYLOGENY

A study of the male and female genitalia and external characters of the nearctic species of Cephidae demonstrates that the genera hitherto recognized do not correctly indicate the phylogenetic relationships within the family. Such a conclusion is strengthened by a study of the available genotype species of the extra limital genera, and representatives of a number of palearctic species.

It has not been possible at present to obtain representatives of sufficient palearctic species to make the study of the phylogeny complete for the world. Sufficient material from the entire world has, however, been studied to make discernable the limits of the genera actually involved by the nearctic species.

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[17a] Ill. Biol. Monogr., xv, p. 30, (1937).

The phylogeny of the Cephidae is based chiefly upon the development of the antennae and tarsal claws. The grouping is also upheld to a certain extent by the male genitalia. While other external characters present some criteria for grouping, they do not show as clearly as the antennae and tarsal claws the true picture of the phylogenetic development.

*Janus* is regarded as the most primitive genus of the Cephidae. The antennae are many segmented (26-28) (Fig. 59) and filiform, with the two basal segments of the flagellum longer than broad and the remaining segments about equal in length and breadth. The tarsal claws are stout with two large nearly equal teeth at nearly right angles to the claw and a large basal lobe present (Fig. 61). In the male genitalia the penis valves appear separated from the base to the tip as has already been mentioned.

From this primitive group there is a dichotomous split. One branch follows the filiform type of antennae with a reduction in the number of segments while in the other branch the antennae tends to become more clavate. The same thing is true in the tarsal claws. In the one branch following the filiform type of antennae the claws remain strongly curved and with a basal lobe, while the members of the other branch tend to have the claws straighter and without a basal lobe.

The one branch represented by *Caenocephus* in our fauna, has a 17-segmented filiform antenna (Fig. 60) which is slightly stouter than the antenna of *Janus*. In *Caenocephus* the tarsal claws are bifid, curved with two subequal teeth and a distinct basal lobe (Fig. 62). The penis valves are similar to those found in *Janus*.

On the other stem there is another dichotomous split. One stem leads to the group having the antennae distinctly clavate beyond the 4th antennal segment, and the tarsal claws curved, bifid and with a small swelling near the base. This stem is represented in the nearctic fauna by the genus *Hartigia*. In this genus the antennae are 23- to 25-segmented (Fig. 58) with the first two or three basal segments of the flagellum longer than wide and the remaining segments about equal in length and breadth. The penis valves are still similar to *Janus* but show a tendency to become fused near the tip.

The other stem includes what seems to be the most highly specialized group of the Cephidae. This group is represented in the nearctic fauna by the genus *Cephus*. The antennae in this genus has the first four or five basal segments of the flagellum at least twice as long as wide, and beyond the 6th or 7th segment become distinctly clavate (Fig. 57). The tarsal claws are variable, but in general are long, slender, gently curved, bifid with the inner tooth subequal to the outer one and at times appearing sub-basal, and the base of the claw slightly tapered, (Figs. 64-66). The male genitalia show a similar specialization in the penis valves. The penis valves are not separated as they are in the other neartic genera but are fused nearly three-quarters or more of the length of the upper portion of the structure (Fig. 1). In *Cephus* the penis valves form a semicircular sheath (Fig. 1) around the membranous penis and are variable in shape (Figs. 2, 3 and 7).

## ACKNOWLEDGMENTS

The writer wishes to express his appreciation to the many persons and institutions who have aided in the present work by the loan of materials or by giving data on the material in their collections.

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[18] The letters in brackets represent abbreviations used throughout this paper to designate the location of specimens examined by the author. Specimens in the author's collection are designated [D.T.R.].

Kansas [K.U.]; United States Entomological Laboratory, Carlisle, Pa. [U.S.Ent.]; United States National Museum, Washington, D.C. [U.S.N.M.]; Washington State College, Pullman, Wash. [W.S.C.]; Homer C. Will, Juniata College, Hungtingdon, Pa. [H.C.W.].

## CEPHIDAE Haliday

1834. Cephites Haliday, Ent. Mag., ii, p. 411.
1839. Cephidae Haliday, Hym. Brit., Synop., p. 1.
1840. Cephides Westwood, Intro. Mod. Class. Ins., ii, Synop. Gen., p. 55.
1871. Cephina Thomson, Hym. Scand., i, p. 317.
1890. Cephini Konow, Deutsch. Ent., ii, p. 227.

Body slender, rather cylindrical, abdomen more or less compressed; legs slender, fore tibia with one bifid apical spur (Fig. 56). Head usually wider than thorax, transverse quadrate to globose; fore margin of clypeus asymmetric, largest lobe on right (Fig. 46); mandibles strong, broad, unequal, the right usually with strong oblique inner tooth (Fig. 27), the left variable (Figs. 23, 26, 28, 33 and 39); antennae many-segmented, usually 17 to 27 segments (Figs. 57, 58, 59 and 60), never bristle-like, usually thickened toward middle or at apex; vertex not or very indistinctly separated from temples. Prothorax well developed (Fig. 44); prosternum protruding so that the head is free from prothorax and slightly tilted forwards; cenchri absent. Wings long and narrow; fore wings with two radial and four cubital cells; costa thick; intercostal cell very narrow, almost wanting; intercostal vein absent; humeral vein crossed behind middle by a slightly oblique vein; hind wing with axillary vein present (Fig. 51).

### *Key to Nearctic Genera of Cephidae*

1. Hind tibiae with pre-apical spurs; hind wings with 2nd transverse cubital vein present (Fig. 52) .......................................... 2
   Hind tibiae without preapical spurs; hind wings without 2nd transverse cubital vein (Fig. 51) .................................. *Caenocephus*
2. Tarsal claws with base wide and lobular below junction of teeth (Fig. 61); antennae filiform throughout (Fig. 59) .................... *Janus*
   Tarsal claws slender with base tapering (Figs. 63 and 66); antennae clavate (Figs. 57 and 58) .......................................... 3
3. Flagellum constricted at base for less than one-quarter its length and with marked shortening of segments occurring beyond third segment (Fig. 58); tarsal claws as in figure 63 ...................... *Hartigia*
   Flagellum constricted for half its length and with marked shortening of the segments not occurring until about fifth or sixth segment (Fig. 58); tarsal claws as in figures 64–66 ........................ *Cephus*

### CAENOCEPHUS Konow

1896. *Caenocephus* Konow, Wien. Ent. Zeit., xv, p. 151.

This genus may be easily distinguished from all other nearctic genera by the absence of the 2nd transverse cubital vein in the hind wing, as well as in the absence of pre-apical spurs on the posterior tibiae.

*Characteristics.*—Head transversely quadrate; front prominently produced between antennae, slightly ridged; antennae distinctly swollen medially, 25-segmented (Fig. 60); clypeal margin asymmetric, largest lobe on right, angulated at ends (Fig. 49); left mandible with two large subequal teeth (Fig. 28); wings hyaline, 2nd transverse cubital vein absent in hind wings and therefore an open submarginal cell present (Fig. 52); hind tibiae without pre-apical spurs; tarsal claws slightly curved, with two stout subequal teeth and with distinct swelling near base (Fig. 62); abdomen compressed, less than twice the length of head and thorax together. Female: 8th abdominal tergite as long as saw-sheath; cerci reaching tip of sheath (Fig. 22); saw with annuli present in lance; alar spines present on lancet (Fig. 37); teeth of lancet broad (Fig. 38). Male: penis valves truncate, tapering at apex, shouldered at base and with distinct tubercles (Fig. 15 and 17); sternites without ornamentation.

GENOTYPE: *Caenocephus jakowleffi* Konow. (Monobasic.) There is but a single species known from the nearctic fauna.

**Caenocephus aldrichi** Bradley

1905. *Caenocephus aldrichi* Bradley, Can. Ent., XXXVII, p. 363. (♀.)
1905. *Caenocephus konowi* Bradley, Can. Ent., XXXVII, p. 363. (♂.) [New synonymy.]

This species, while closely resembling *Hartigia cowichana* Ries, is quite distinctive in its morphological characters. The lack of pre-apical spurs on the posterior tibiae and the absence of the 2nd transverse cubital vein in the hind wing readily separate it from other members of the family.

*Characteristics.*—Black; legs except coxae (and trochanters in ♂), second, third, and fourth abdominal tergites (only 2nd and 3rd in ♂) red; wings yellowish to smoky with deep violaceous reflections.

♀. Head black, minutely and evenly covered with setiferous punctures; punctures obsolete around ocelli; postocellar line equal to ocellocular line; lateral ocellar line sightly greater than diameter of posterior ocelli; a shining impunctate area cephalo-laterad of posterior ocelli; ocellar basin long, oval, with a longitudinal projection in front; front between antennae prominent, not flattened; antennal fovae deeply concave, shining, impunctate, with upper margins forming definite supra-antennal carinae; antennae short, 25-segmented, slightly thickened medially, third segment slightly longer than fourth; mandibles rufous, palpi brownish.

Pronotum closely and evenly covered with minute setiferous punctures; prescutum, scutum, scutellum, and mesepisternum closely and slightly more coarsely punctured; membrances brownish.

Wings smoky with violaceous reflections, slightly fuscous near base and along transverse cubital and discoidal veins of fore wings; a slightly infuscated area near base of hind wings. Legs red, coxae, and basal portions of trochanters black.

Abdomen compressed; second and third tergites and sternites, and fourth tergite red; remainder of abdomen, cerci, and sheath black.

Length, 15 mm.; length of fore wing, 12.3 mm.

♂. Head black, shining; vertex with scattered, very minute punctures; postocellar line equal to ocellocular line; lateral ocellar line about equal to the diameter of posterior ocelli; a slight depression cephalo-laterad of posterior ocelli; ocellar basin deep and oval; front prominent between antennae, slightly ridged; antennae 25-segmented and sightly swollen medially, third segment slightly longer than fourth; antennal fovae deep, impunctate, shining; upper margins forming definite supra-antennal carinae; mandibles rufous; palpi brownish.

Pronotum slightly more thickly punctured than vertex; prescutum, scutum and mesepisternum more distinctly punctured and covered with fine pubescence; scutellum sparsely but distinctly punctured; membranes creamy brown.

Wings hyaline with slightly yellowish to smoky cast, without distinct violaceous reflections; veins brown. Legs yellowish red except coxae and trochanters which are brown.

Abdomen compressed; black except orange yellow band at base of second and third tergites and upper basal margin of same sternites.

Length, 9.5 mm.; length of fore wing, 7 mm.

Inasmuch as there is but a single nearctic species in this genus, the same distinguishing characters as given under the generic description will apply to the species.

*Type*:—A female collected at Juliaetta, Idaho, by J. M. Aldrich, is no. 1373.1 in the collection of Cornell University. This specimen has been examined and is in fair condition. One antenna, wings of the left side, the left mandible, a hind leg, and the saw have been removed from the specimen and are mounted on slides. The slides are also in the Cornell University collection.

The type of *Caenocephus konowi* Bradley, a male, labelled "W.T." [probably Washington Territory], is in the Academy of

Natural Sciences of Philadelphia, no. 10356, and has also been examined. This specimen was apparently from the Morrison material secured by the above institution.

Although Doctor Bradley described the male and female as two separate species there is no doubt in my mind but that they are the opposite sexes of the same species and I am therefore placing them together under the name *aldrichi.* Material of this species is not abundant, but a study of the morphological characters of the specimens at hand shows, in my opinion, that they should be placed together.

*Specimens examined:* Total 5; 2 ♀; 3 ♂.

IDAHO: 1 ♀, Juliaetta, (J. M. Aldrich), [C.U., type]. 1 ♂, Moscow, (J. M. Aldrich), [C.U., paratype of *C. konowi*].

WASHINGTON TERRITORY: 2 ♂, "W. T.", (Morrison?), [A.N.S.P., type and paratype of *C. konowi*].

CANADA: 1 ♀, Victoria, British Columbia, 1903, (Hankon), [C.N.C.].

*Life History:*—The life history and immature stages as well as the host plant are unknown.

## CEPHUS Latreille

1802. *Cephus* Latreille, Hist. Nat., III, p. 303.

GENOTYPE: *Sirex pygmaeus* Linnaeus = *Cephus pygmaeus* (Linnaeus). (By subsequent designation of Latreille, 1810.[19]).

This genus was first recognized by Jurine in the Erlangen List [20] & [21] using the name *Astatus* with *Sirex pygmaeus* Linnaeus as a monotypic genotype. However the name *Astatus* was preoccupied, having been used by Latreille [22] in 1796 for an aculeate wasp. The names contained in the Erlangen list have been set aside by the Commission of Zoological Nomenclature meeting with the Zoological Congress in Lisbon in 1935,[23] so that the Jurinean name will become obsolete as well as preoccupied.

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[19] Consid. Gener. Ord. Nat. Animal., p. 435, (1810).

[20] Erlangen Litt. Ztg., I, p. 163, (1801).

[21] Morice and Durrant, *Trans. Ent. Soc. London,* 1914, pp. 339–436, (1915). [A facsimile of the rare original "Erlangen List".]

[22] Prec. Caract. Gen. Ins., p. 114, (1796).

[23] Ent. Rec., XLVII, p. 216, (1935).

The name *Astatus* as used by Panzer[24] in 1801 is not identical with *Astatus* Jurine 1801. *Astatus* Panzer has for its genotype *Sirex troglodyta* Fabricius by subsequent designation of Rohwer.[25] But as has been said the name *Astatus* was already preoccupied by Latreille 1796,[22] as well as by Jurine, May 1801,[20] while Panzer's name was not published until July 1801.

The name *Cephus* proposed by Latreille in 1802[26] therefore becomes valid with its genotype *Sirex pygmaeus* Linnaeus by subsequent designation of Latreille in 1810.[27]

The genus *Calameuta* erected by Konow[28] now becomes a synonym of *Cephus*. Species of Konow's genus may easily be separated from *Cephus* on the basis of male genitalia, and to some extent on the female saw, but external characters of the antennae and tarsal claws show without doubt that this genus should be synonymized with *Cephus*.

The genus *Trachelus* Jurine[29] also becomes a synonym of *Cephus* Latreille. In this group we find that on the basis of male genitalia and external male characters it seems to be far removed from the other members of *Cephus*, but the female fails to exhibit sufficient differences to allow it to be classed as a distinct genus. Examination of the tarsal claws and antennae places it definitely with genus *Cephus*. However, because of the structure of the seventh and eighth abdominal sternites in the male, this group is being made a subgenus of *Cephus*.

The members of this genus may be separated from the species of other nearctic genera by the distinctly clavate antennae (Fig. 57) and the long, narrow, gently curved, bifid claws (Fig. 66).

*Characteristics.*—Head transversely quadrate to sub-globose; body slender, rather short; abdomen seldom more than one and one-half times the length of head and thorax together; antennae thin, slender, 19- to 23-segmented, clavate beyond sixth or seventh segment, basal segments at least twice as long as wide (Fig. 57); left mandible varying from tridentate (Fig. 39) to bidentate with distinct shoulder on inner tooth (Fig. 33);

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[24] Faun. Germ. Ins., heft 83, pl. 12, (1801).

[25] U.S.D.A., Bur. Ent. Tech. Bull., ser. 20, pt. 2, p. 74, (1911).

[26] Hist. Nat. Insect., III, p. 303, (1802).

[27] Consid. Gener. Ord. Nat. Animal., p. 435, (1810).

[28] Wien. Ent. Zeit., XV, p. 159, (1896).

[29] Nouv. Meth. Class. Hym., p. 70, (1807).

hind wings with 2nd transverse cubital present (Fig. 51); clypeal margin asymmetric, largest portion on right, ends distinctly angulated (Fig. 46); posterior tibiae with one or two pre-apical spurs; tarsal claws long, slender, narrow, gently curved, and bifid at apex (Figs. 64, 65 and 66); pronotum broader than long and slightly concave on apical margin. Female: saw without annuli or alar spines (Fig. 40); teeth of lancet angular (Figs. 41–43). Male: 6th to 8th abdominal sternites either simple or with ornamentation; penis valves variable (Figs. 2, 3, and 7).

The genus *Cephus* embraces a large number of species belonging to a number of the hitherto recognized palearctic genera. These genera differ radically in the genitalia and ornamentation of the 6th to 8th abdominal sternites in the male. All other characters, however, tend to group them into a single phylogenetic unit, characterized by the shape of the tarsal claws (Fig. 66) and antennae (Fig. 57).

In the nearctic fauna the genus contains four species, two of which, *C. pygmaeus* (Linnaeus) and *C. tabidus* (Fabricius), are holarctic forms. These two species as well as *C. cinctus* Norton are pests of wheat and other grains.

In studying the nearctic species as well as many of the palearctic forms we find that the former, now placed in the genus *Cephus,* represent the extremes of a large group, which, on the basis of female characters would stand as a single genus, but on the basis of male characters may be divided into two distinct subgenera as follows:

Seventh and eighth sternites in male with bristle-filled depressions (Fig. 10). . Subgenus *Trachelus*

Seventh and eighth sternites in male without bristle-filled depressions, at most with a row of scale-like setae on the apical margin of the eighth sternite (Figs. 4 and 9).............................Subgenus *Cephus*

The subgenus *Cephus* Latreille in the nearctic region embraces the genus *Calameuta* of Konow. In the males of the nearctic species of *Cephus* there is a row of scale-like setae on the apical margin of the eighth sternite (Figs. 4 and 5), while in *Calameuta* only a row of very fine setae are present on the apical margin of the eighth sternite (Fig. 9). In *Cephus* the left mandible is distinctly tridentate (Fig. 39), while in *Calameuta* it has the middle tooth joined to the inner one, presenting a distinctly shouldered effect (Fig. 33) and giving the mandible the appearance of being bidentate. Under the subgenus *Cephus* are found three nearctic species, namely, *C. pygmaeus* (Linnaeus), *C. cinctus* Norton, and *C. clavatus* (Norton).

The subgenus *Trachelus* Fabricius is characterized by the males having a cavity filled with long needle-like setae on each of the seventh and eighth abdominal sternites (Fig. 10). It contains but a single species, *C. tabidus* (Fabricius), in the nearctic fauna.

Although the genus *Cephus* seems to embrace very widely separated forms in the nearctic region, an examination of the genotypes of palaearctic genera clearly shows the intermediate forms between the extremes represented by the nearctic species.

### *Key to Nearctic Species of Cephus*

1. Abdomen with last sternite undivided (Fig. 4); males................2
   Apex of abdomen with sheath (Fig. 20); females....................5
2. Seventh and eighth abdominal sternites with cavities filled with long needle-like setae (Fig. 10)..................................*tabidus*
   Seventh and eighth abdominal sternites without setae-filled cavities, at most with a fringe of scale-like setae on apical margin of eighth sternite. ........................................................3
3. Penis valve blunt at apex (Figs. 2, 3); left mandible tridentate (Fig. 39); eighth sternite with row of scale-like setae on apical margin (Fig. 4) ........................................................4
   Penis valve sharply pointed at apex (Fig. 7); left mandible bidentate (Fig. 33); eighth abdominal sternite with row of fine, short setae on apical margin (Fig. 9)..................................*clavatus*
4. Eighth abdominal sternite with medial emargination on apical margin (Fig. 4); stigma and costa of fore wing uniform brown; mesepisternum black ..........................................*pygmaeus*
   Eighth abdominal sternite straight on apical margin (Fig. 5); costa of fore wing yellow, stigma black; upper angle of mesepisternum yellow. *cinctus*
5. Left mandible tridentate (Fig. 39)................................6
   Left mandible bidentate with inner tooth shouldered (Fig. 33)..*clavatus*
6. Cerci long, slender, at least half the length of the sheath (Fig. 25); species black with a row of lateral yellow spots on 2nd to 8th tergites. ..................................................*tabidus*
   Cerci short, less than one-half the length of the sheath (Fig. 20); species black with distinct yellow banding on abdomen ..................7
7. Costa and stigma of fore wing uniform brown; mesepisternum black. *pygmaeus*
   Costa yellow; stigma black; upper angle of mesepisternum yellow. *cinctus*

### Subgenus **CEPHUS** Latreille

1801. *Astatus* Jurine, Erlang. Litt. Ztg., I, p. 163. (Genotype: *Sirex pygmaeus* Linnaeus. Monobasic.)

1802. *Cephus* Latreille, Hist. Nat., III, p. 303. (Genotype: *Sirex pygmaeus* Linnaeus, by subsequent designation of Latreille, 1810.)[30]

1896. *Calameuta* Konow, Wien. Ent. Zeit., XV, p. 159. (Genotype: *Cephus filiformis* Eversmann, by subsequent designation of Rohwer 1911.)[31] [New synonymy.]

The three nearctic species contained in this subgenus are closely related forms and there has been some confusion in separating them. This is due in part to the large variation in the color of individual specimens.

If color alone were used it would be difficult to separate *clavatus* and *cinctus,* both of which have similar habitats. A study of the left mandible of these two species will at once separate them in both sexes. This in *cinctus* has two distinct subequal outer teeth with a smaller free tooth between (Fig. 39), while in *clavatus* the small middle tooth has become fused with the inner tooth (Fig. 33). The males of these two species are also easily separated on a comparison of the genitalia. In *cinctus* the penis valves are long, broad and blunt on the apex (Fig. 2), while in *clavatus* this organ is distinctly and sharply pointed at the tip (Fig. 7). The ornamentation of the eighth abdominal sternite, as given in the key to species, will also separate the males of these two species.

*Pygmaeus* and *cinctus* have also been confused. Both of these species are injurious to wheat and other grains. The former species are introduced into this country from Europe and thus far its distribution has been confined to the eastern states, mainly New York and Pennsylvania. The latter species is indigenous and is found from the Pacific Coast states eastward as far as Ohio, as well as in the western provinces of Canada. Most of the damage done by *cinctus* has been confined to the wheat growing areas west of the Mississippi River. Both vary greatly in their color patterns, but the characters used in the above key have been found dependable in all specimens examined. In the males the apical margin of the eighth sternite has offered a very dependable character for their separation. In *pygmaeus* it is distinctly emarginated (Fig. 4), while in *cinctus* the apical margin forms nearly a straight line (Fig. 5). The presence of the black band in the stigma of *cinctus* has also been a dependable character in both sexes regardless of color variations in other portions.

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[30] Consid. Gen. Ord. Nat. Animal., p. 435, (1810).

[31] U.S.D.A., Bur. Ent., Tech. Bull., ser. 20, pt. 2, p. 76, (1911).

Some workers have tentatively considered *pygmaeus* and *cinctus* a single species, or contemplated placing *cinctus* as a variety of *pygmaeus*. After studying the larvae of both species I feel that they should remain as two valid species. The larvae are easily separated by the anal prong. In *pygmaeus* the anal prong terminates in a short chitinized ring which is not as long as broad (Fig. 68), while in *cinctus* the anal prong terminates in a chitinized tube-like process which is distinctly longer than broad (Fig. 67).

**Cephus pygmaeus** (Linnaeus)

1762. *Tenthredo sp.* Geoffroire, Hist. Abr. Ins., II, p. 228, no. 38.
1766. *Sirex pygmaeus* Linnaeus, Syst. nat., Edit. 12, p. 929, no. 7.
1781. *Sirex pygmaea* Fabricius, Spec. Ins., I, p. 420, no. 12.
1785. *Tenthredo longicornis* Fourcroy, Entom. Paris, p. 378.
1801. *Banchus spinipes* Panzer, Faun. Ins. Germ., I, p. 92.
1802. *Cephus pygmaeus* Latreille, Hist. Nat. Ins., III, p. 303.
1803. *Astatus pygmaeus* Klug, Monogr. Siric. Germ., p. 50, no. 2.
1803. *Astatus spinipes* Klug, Monogr. Siric. Germ., p. 51, no. 3.
1803. *Astatus floralis* Klug, Monogr. Siric. Germ., p. 53, no. 5.
1804. *Banchus viridator* Fabricius, Syst. Piez., p. 127, no. 5.
1805. *Pamphilius longicornis* Latreille, Hist. Nat. Insect., XIII, p. 140, no. 5.
1806. *Cephus spinipes* Panzer, Krit. Revis. Insekteng. Deuschl., II, p. 144.
1807. *Trachelus pygmaeus* Jurine, Nouv. Meth. Class. Hymen., I, p. 72.
1823. *Cephus Leskii* Lepeletier, Monogr. Tenthred., p. 20, no. 58.
1835. *Cephus atripes* Stephens, Illus. Brit. Entom., VII, p. 105, no. 4.
1835. *Cephus floralis* Stephens, Illus. Brit. Entom., VII, p. 106, no. 7.
1847. *Cephus cultratus* Eversmann, Bull. Soc. Natural., Moscow, XX, p. 64, no. 5.
1849. *Tenthredo (Cephus) pygmaeus* Blanchard, Cuvier, Regne Anim., Ed. [3a], [XIII (Insect. Text)], p. 128.
1882. *Cephus flavisternus* A. Costa, Rendic. Acc. Sci. Fis., p. 198, (♀).
1894. *Cephus clypealis* A. Costa, Prosp. Ins. Ital., III, p. 250, (♂).

I have not personally examined all the species placed in the synonymy of this species, but have compiled them from the works of Kirby,[82] Dalla Torre,[83] Konow,[84] and Enslin.[85]

This species may be easily distinguished from *cinctus* by the mesepisternum being entirely black and the stigma and costa being uniform brown. The male is easily separated from the other members of the genus by the genitalia (Fig. 1) and the female be separated from those of *clavatus* by the shape of the left mandible (Fig. 39) and from those of *tabidus* by the color as well as by the short cerci (Fig. 20).

*Characteristics.*—Black and yellow, head not contracted behind eyes; usually two yellow bands on abdomen; legs black with males, femora and tibiae yellow externally in the females. Both sexes vary a great deal in coloration.

♀. Head transversely quadrate, black, concave behind, shining; vertex with numerous, fine, setiferous punctures; postocellar line equal to ocellocular line; a slight impunctate depression from behind posterior ocelli around outer margin and following a cephalo-laterad direction; lateral ocellar line slightly longer than diameter of posterior ocelli; ocellar basin shallow, impunctate; front slightly raised above, flattened between antennae; antennae 23-segmented, distinctly clavate beyond seventh segment and again tapering slightly at apex, base black, slightly ferruginous at apex; face shining, smooth, sparsely covered with fine setiferous punctures; base of mandibles yellow, tips red; palpi yellow except for brownish apices.

Pronotum distinctly wider than long, punctures slightly less distinct than on vertex; praescutum sparsely punctured; scutum sparsely punctured medially, more coarsely punctured laterally; scutellum smooth, shining, and with but few setiferous punctures; mesepisternum, except upper margin, closely and confluently covered with fine punctures and long, light, stiff pubescence. Thorax black, membranes yellow.

Wings slightly smoky to iridescent; costa except for yellow base, and stigma brown; remainder of veins brown. Coxae, trochanters, and femora, except external apex of fore and middle femora, black; fore and middle tibiae yellow, except inner apical half of middle tibiae, inner portion of middle tarsi, inner portion of hind tibiae and their entire tarsi brownish; claws orange-red.

Abdomen black, usually broad apical band on third and fourth tergites, narrow apical band on eighth tergite, and often interrupted apical spots on second and median spot and lateral line on sixth tergites, lemon yellow. Apical margin of last tergite orange-yellow; sterna black. Cerci brownish yellow; sheath black except for orange tip and often a yellow base.

Length, 8.5 mm., length of fore wing, 8.0 mm.

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[82] List Hym. Brit. Mus., I, pp. 357–358, (1882).

[83] Catal. Hym., I, pp. 410–412, (1894).

[84] Zeit. Syst. Hym. u. Dipt., IV, p. 250, (1904).

[85] Die Tenthred. Mitteleur., p. 699, (1912).

♂. Differs from female in having more yellow; mandibles except rufous tip, bifurcate spot on clypeus, malar space, lower inner orbits, lower genae, sternum of thorax, fore and middle coxae, trochanters and femora in front, fore and middle tarsi except claws, hind coxae except inner surface, a wide line on anterior portion of their femora, and external portion of their tibiae, yellow; usually irregular apical band on second to sixth sternites, narrow apical band on seventh sternite, yellow.

Length, 8.0 mm.; length of fore wing, 6.0 mm.

This species shows a great deal of variation in the yellow markings, especially on the abdomen, as well as variation in the number of pre-apical spurs on the hind tibiae. Early authors have mentioned this species as having two pre-apical spurs on each hind tibia. However, in studying a long series of specimens from both this country and Europe, it was found that this character is not reliable. Among 200 specimens examined, 130 were found having two pre-apical spurs on each hind tibia; 55 had only a single pre-apical spur on each, while the remaining 15 possessed one pre-apical spur on one side and two on the other. Some that showed this latter condition might have had one spur broken off, but for the most part it seemed to be a natural occurrence. This pre-apical spur character seemed to be more variable in the male than in the female. A smaller percentage of variation was found in the European specimens examined. Mr. Benson, in a personal communication, informs me that he has found a similar variation in the European material he has examined in the British Museum of Natural History. The variation he found was slightly less than that found in the nearctic material.

*Type*:—According to Mr. Benson, the type of this species is not in the Linnean Collection in London and he has not been able to locate it in any other. He feels it is, in all probability, lost.

*Distribution*:—This species has been recorded from thirteen countries of Europe and Asia and from four of the United States.

*Specimens examined:* Total 1545; 872♀; 673♂.

CONNECTICUT: 1♂, Hamden, June 11, 1914, (W. E. Britton), [Conn.].

MASSACHUSETTS: 1♀, "Mass", [C.U.].

NEW YORK: 839♀, 661♂, Ithaca, May 23–June 10, 1889, 1920, 1923, 1935, (J. H. Comstock, M. D. Leonard, D. T. Ries), [C.U., A.N.S.P., I.U., Ill., B.M.N.H., N.Y.S., D.T.R.]. 2♀, Olcott, June 2–20, 1925, 1933, (H. Dietrich), [B.M.N.H.]. 7♀, 1♂, Rochester Junction, June 11–July 12, 1914, (M. D. Leonard), [C.U., B.M.N.H., A.N.S.P.]. 3♀, West Danby; 6♀, 8♂, McLean, May 31, 1890, 1913, [C.U.]. 4♀, Victor, June 9, 1908, [C.U.]. 1♀, Lockport, June 25, 1935, (L. L. Pechuman), [D.T.R.].

Larvae were recorded during 1925 by C. R. Crosby and D. T. Ries[36] from the following counties: Cayuga, Chemung, Columbia, Erie, Genesee, Livingston, Monroe, Niagara, Onondaga, Ontario, Orleans, Oswego, Schuyler, Seneca, Steuben, Tompkins, Wayne, Westchester, Wyoming, and Yates.

PENNSYLVANIA: 1♀, Rockville, May 22, 1919; 2♂, 2♀, Hummelstown; 2♀, Inglenook, May 1921, (J. N. Knull); 1♀, Edenville, May 26, 1922, F. C. Craighead); 3♀, Progress, June 1, 1922, (F. M. Trimble), [all Penn.].

Larval records were made during June and July 1925, by P. R. Myers and D. T. Ries[37] from the following counties: Bradford, Columbia, Cumberland, Dauphin, Juniata, Lebanon, Lycoming, Montour, Northumberland, Perry, Snyder, Tioga, Union, and York. The species has also been recorded by C. C. Hill[38] from the following counties: Centre, Berks, Chester, Lehigh, Northampton, Bucks, Mifflin, Huntingdon, and Lancaster.

*Life History*:—The biology of this species has been carefully studied in both this country and in Europe and Asia. A large number of papers, far too numerous to list here, has been published in nearly every language; many of the more recent ones are in Russian, in which country the insect has caused severe damage to cereal crops. The writer published a detailed account of the biology in 1926.[39] A resume of the life history as given in that paper follows.

The adults appear the latter part of May or early June in the vicinity of Ithaca, New York, and feed on the pollen of yellow flowers, such as mustard and yellow sweet clover. The eggs are deposited soon after the adults emerge, in the hollow center of the stems just below the growing tip. The egg is shiny, nearly transparent, and averages 1.11 mm. in length, with an average minimum width of 0.45 mm. and an average maximum width of 0.5 mm. It is distinctly crescent-shaped when first laid, but after a day or two assumes a reniform shape. They hatch in seven to ten days.

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[36] Jour. Agr. Res., xxxii, p. 279, (1926).

[37] Jour. Agr. Res., xxxii, p. 280, (1926).

[38] Bur. Ent. & Pl. Quar., Mimeographed Circ. E 334, 4 pp., 2 figs., (1935).

[39] Jour. Agr. Res., xxxii, pp. 277–295, (1926).

When the young larva first hatches it has a large brown chitinous head and a weak, slender body. It is U-shaped at first and measures about 1.75 mm. in length. The head capsule averages 0.28 mm. in width, while the body averages 0.17 mm. in width. It is footless, the position of the legs being marked by small round tubercles, each of which terminates in a few short bristles, which are present in the first instar.

The larva feeds on the delicate parenchymatous tissue lining the inside of the stem. As it reaches a node it excavates a tunnel and proceeds to the next node. It traverses the tunnel several times during the season and there are apparently four or five instars, the exact number being difficult to determine because of the larval habit of going back and forth through the tunnel and of devouring the cast skins in doing so.

The active feeding period of the larva lasts about a month before a plug of frass is placed in the stem about an inch to an inch and a half above the ground. Below this plug of frass the larva cuts a V-shaped groove around the interior of the culm, leaving only the epidermis uncut. Immediately below this groove it places another plug of frass. The lower plug is deeply concave on the upper surface while the lower surface, to which the hibernating cocoon it attached, is flat. The V-shaped groove causes the stem to break off, leaving a very ragged edge to the stubble, characteristic of this species.

The mature larva measures 10 to 14 mm. in length and is yellowish green in color. The body is nearly cylindrical. The head is of medium size, smaller than the thoracic segments which are somewhat swollen. The abdomen tapers gradually from the thorax to the caudal end. The antennae are 4-segmented and taper strongly. A short distance ventro-caudad of each antenna is a single black ocellus. The labrum is prominent and slightly emarginate. The mandibles are strongly toothed. The maxillary palpi are 4-segmented. There are ten pairs of spiracles, two thoracic and eight abdominal. The prothoracic spiracles are much larger than the others and greatly elongated. The thoracic legs are represented by very short tubercles. The caudal tubercle, dorsad of the vent, is prominent. There are a few slender, scattered hairs on the head and a quantity of stronger, more spine-like hairs at the caudal end. The caudal tubercle terminates in a chitinous ferrule-like ring (fig. 68) which is not as long as broad.

In May the larva transforms into a pupa which is milky white, slender, 10 to 12 mm. in length and 1 to 2 mm. in width. This stage lasts about two weeks. The emerging adult pushes and chews its way through the plug of frass above the cocoon. There is but one generation a year.

*Hosts.*—The food plants of this species are comparatively few, the principal hosts being wheat, barley, and rye. Several instances of *pygmaeus* infesting *Bromus secalinus* Linnaeus were observed in 1924.[40] Noel[41] reports this insect attacking oats in France, while Zacher[42] reported it attacking meadow grasses in Germany. Neither of these hosts has been recorded as being attacked in this country.

### **Cephus cinctus** Norton

1872. *Cephus cinctus* Norton, Trans. Amer. Ent. Soc., IV, p. 86.
1891. *Cephus occidentalis* Riley and Marlatt, Ins. Life, IV, p. 177.
1898. *Cephus graenicheri* Ashmead, Can. Ent., XXX, p. 182.

This species may be distinguished from *pygmaeus* in both sexes by the dark band across the stigma, as well as by the slight constriction of the head behind the eyes. It may be separated from the other species of the genus by the presence of scale-like setae on the apical margin of the seventh sternite.

*Characteristics.*—Black and yellow; the head slightly restricted behind eyes; usually two or three yellow bands and spots on the abdomen; legs in the female more or less yellow except at base, in the male yellow except for black patches on femora.

♀. Head black, shining, transversely quadrate, very slightly constricted behind the eyes; vertex with fine scattered punctures and bearing a slight pubescence; ocellocular line greater than postocellar line; an oblique depression running from behind posterior ocelli in a cephalo-laterad direction; head shining and almost impunctate behind posterior ocelli; lateral ocellar line equal to diameter of posterior ocelli; ocellar basin distinct, longitudinal, and impunctate; front slightly raised above base of antennae, flattened

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[40] Jour. Agr. Res., XXXII, p. 281, (1926).

[41] Lab. Ent. Agr. Seine-Inf. Bul. Trimest., 1915, (1), pp. 4–7.

[42] Deut. Landw. Presse, XCVI, pp. 59 & 445, (1919).

antennae 19- to 20-segmented, slightly clavate beyond eighth segment, black at base, lightening to ferruginous from seventh segment to tip; face shining and sparsely covered with setiferous punctures; clypeus asymmetric; mandibles yellow, tips red; palpi yellow with apices brown; clypeus usually black but may bear distinct or indistinct yellow markings.

Pronotum shining, slightly emarginate behind, wider than long, and with very fine, scattered setiferous punctures; praescutum with few, coarser punctures medially; scutum with less scattered punctures laterally; scutellum smooth, shining, and with very few, fine, scattered punctures; mesepisternum with fine, confluent setiferous punctures, upper margin yellow.

Wings light smoky hyaline with violaceous reflections; costa and outer margin of stigma yellow, inner margin dark brown to black; remaining veins brown. Coxae, trochanters, interior of fore, basal portion of middle, and interior portion and sometimes apex of hind femora black; remainder of legs yellow, except apices of hind tibiae and all tarsi brownish; claws reddish.

Abdomen black except broad band on third and fifth tergites and sometimes latero-apical spot on fourth, and a spot or broad band on sixth yellow, last tergite entirely yellow; indistinct yellow band on last sternite; cerci brownish yellow to yellow, broad; sheath brown, often with tip and base yellow, short, narrow, bluntly pointed; saw dark amber.

Length, 8.5 mm., length of fore wing, 6.0 mm.

♂. Differs from female in having more yellow; mandible except tips, clypeus, lower face, malar space, inner orbits, entire venter of thorax, sides of mesepisternum, coxae except exterior, trochanters except hind pair, femora except stripe on fore and middle pairs, tibiae except apex of hind pair, yellow. Abdomen black; lateral apical spot on first and second, broad band on third and fifth, indistinct lateral apical spot on sixth and seventh, entire eighth tergites; apical margin of fifth, sixth, seventh, and entire eighth sternites; yellow to yellowish brown.

Length, 8.5 mm., length of fore wing, 6.5 mm.

This species, like *pygmaeus*, is subject to a great deal of variation in both color and structure. The shape of the head varies from transverse-quadrate to almost transverse-globose. The postocellar line may be distinctly shorter than, subequal to, or even longer than, the ocellocular line. There are also all degrees of differences in the extent of the ocellar basin in front of the anterior ocellus. In studying these differences I examined a large series of specimens from the different museums as well as the series studied by Rohwer[43] in the United States National Museum.

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[43] Proc. Ent. Soc. Wash., XIX, pp. 139–141, (1917).

The color range is also extensive. The face of the female, while normally black, may be mostly yellow or indistinctly mottled with yellow. A similar color variation was observed on the femora, which are normally mostly yellow; in a few smaller individuals they were entirely black and all degrees of variation were found. The banding of the tergites is extremely variable. Specimens from Manitoba have only two narrow yellow bands on the third and fifth tergites, while specimens from California and Washington have the abdomen almost entirely yellow with two or three narrow bands of black. The wings vary from hyaline to distinctly infuscated. The antennae, normally 20-segmented, vary from eighteen to twenty-one segments. Variation in the number of pre-apical spurs are discussed under *C. pygmaeus,* was also found in this species.

*Type.*—A male labelled " Colo " in the Academy of Natural Sciences of Philadelphia, no. 10349. I have examined this specimen and found it in good condition.

*Cephus occidentalis* Riley & Marlatt (U.S.N.M., type no. 21075) was first placed as a synonym of *C. cinctus* Norton, by Konow.[44] The same author in a later publication [45] also placed *Cephus graenicheri* Ashmead (U.S.N.M., type no. 6842) as a synonym of *cinctus.* Rohwer [46] followed the decision of Konow. The types of both of these species have been examined by me in the United States National Museum at Washington. I find them conspecific with *Cephus cinctus* Norton and should be placed as synonyms of that species.

*Distribution.*—In addition to the localities listed below, from which specimens have been examined, Ainslie [47] also reports the occurrence of this species in Missouri, Nebraska, and Wyoming.

*Specimens Examined:* Total 773; 460♀, 313♂.

ARIZONA: 1♀, Oak Creek Canyon, (Snow), [K.U.].

CALIFORNIA: 1♀, Mill Valley, May 7, 1927, 6♀, Tennant, June 19, 1934, (K. A. Salmon), [Ill.]. 1♂, Huntingdon Lake, Fresno County, July 7, 1919; 2♂, Yosemite Valley, June 7, 1921; 1♀, Blue Lakes, Lake County,

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[44] Ent. Nachr., xxiv, p. 78, (1898).

[45] Zeit. Syst. Hym. u. Dipt., iv, p. 294, (1904).

[46] Proc. Ent. Soc. Wash., xix, p. 139, (1917).

[47] U.S.D.A., Tech. Bull., n°. 157, pp. 1–8, (1929).

May 16, 1922; 1♀, Mark West Springs, May 10, 1930; 1♂, Bradley, April 13, 1917; 2♂, Livermore, June 11, 1930; 1♂, Truckee, June 18, 1927; 1♂, Yorkville, June 24, 1928, (E. P. Van Duzee); 1♂, 1♀, Shasta Springs, June 6, 1920), (C. L. Fox); 5♀, 4♂, Manitou, June 17, 1922, 1926, & 1928, (C. L. Fox, E. C. VanDyke); 1♂, Hurleton, May 26, 1928; 1♀, Ben Lomand, May 16, 1931, (E. C. VanDyke); 1♀, Bear Valley, Santa Cruz Mts., Aug. 1913, (F. C. Clark); 1♀, Fort Tejon, May 29, 1927, (A. C. Davis); 1♂, Sobre Vista, May 19, 1910, (J. A. Kusche); 2♂, Yorkville, April 24, 1928, (H. H. Kiefer); 1♂, Crystal Lakes, (F. E. Blaisdell), [all C.A.S]. 1♂, 1♀, Yosemite, June 7, 1928; 1♀, Santa Cruz, June 6, 1922; 1♀, Fort Seward, June 7, 1935, (E. O. Essig), [all U.Cal.]. 2♂ 2♀ Felton, Santa Cruz Mts., May 20–25, 1907, (J. C. Bradley), [C.U., A.N.S.P., B.M.N.H.]. 1♂, Scotia, (H. S. Barber); 2♀, 6♂, Santa Clara County, (2♀, type and paratype of *C. occidentalis*); 1♂, 4♀, Santa Cruz Mts., (paratypes of *C. occidentalis*), [U.S.N.M.].

Colorado: 1♂, 1♀, Boulder, June 19, 1933, (M. T. James); 1♂, 1♀, "Colo", (Baker), 1♂, "Colo"; [all Ill.]. 1♀, Colorado Springs, June 8–10, 1902 & 1915, (M. C. VanDuzee in part), [C.U., I.U.]. 3♀, 1♂, Fort Collins, July 5–28, 1895, 1896, & 1903; 1♀, Steamboat Springs, July 1; 1♂, Horsetooth Gulch, June 18, 1895, (C. F. Baker); 1♀, Livermore, July 15, 1900; [all U.S.N.M.]. 1♀, "Colo", 1♂, "Colo", [A.N.S.P., type of *C. cinctus*]. 1♀, "Colo", [I.U.].

Idaho: 1♀, Moscow, June 20, 1936, (B. F. Coon), [Ida.].

Illinois: 1♀, Erie, June 14, 1932, (Frison & Mohr); 1♀, Gray's Lake, May 13, 1930, (Frison & Ross); 1♀, Hardin, June 5–9, 1930, (H. L. Dozier); [all Ill.].

Iowa: 1♀, Mt. Pleasant, June 28, 1929, (Hills), [Ill.].

Kansas: 1♂, Barton County, (S. J. Hunter), [K.U.].

Michigan: 1♀, Douglas Lake, July 1928, (H. C. Will), [H. C. W.]. 1♀, Douglas Lake, July, (C. H. Kennedy), [O.S.U.].

Minnesota: 1♀, Shakopee, June 24, 1914, (C. N. Ainslie), [U.S.N.M.].

Montana: 45♀, 32♂, Missoula, May 1916, (W. H. Larimer, C. N. Ainslie), [U.S.N.M.]. 10♀, 14♂, "Mont.", [A.N.S.P.]. 1♂, Wells, June 6, 1915, (M. C. VanDuzee), [I.U.]. 1♂, 2♀, Sidney, June 14, 1913, [Ill.]. 1♂, Gallatin County, June 27, 1900, [Ill.].

Nevada: 1♀, Carson City, June 26, 1929, (E. P. VanDuzee), [C.A.S.]. 1♀, 4♂, Nevada, [A.N.S.P.].

New Mexico: 1♂, Jenney Springs, June 29, 1910, (J. Woodgate), [C.U.]. 1♀, "New Mexico", (Cockerell), [A.N.S.P.].

North Dakota: 1♂, Bottineau; 2♀, Souris, (C. N. Ainslie), [B.M.N.H., D.T.R.].

Ohio: 1♀, Put-in-Bay Island, June 20–30, (C. H. Kennedy), [O.S.U.]. 1♀, Columbus, June 1922, (J. N. Knull), [U.S.N.M.].

Oregon: 5♀, 1♂, Corvallis, June 10, 1929 in part, (H. A. Scullen in part), [Ore., C.U.]. 2♀, Corvallis, June 5, 1928, (H. A. Scullen & Jamison), [Ore.].

SOUTH DAKOTA: 1♂, Lead, July 12, 1923, (H. C. Severin), [Ill.].

UTAH: 5♂, 10♀, Salt Lake City, June 10–24, 1897, 1922, 1926, (E. C. VanDyke, C. N. Ainslie, E. P. VanDuzee in part), [all C.A.S., U.S.N.M., A.N.S.P.]. 1♂, Provo, (Wickham); 8♀, 3♂, Kimball, June 1, 1912; 35♀, 19♂, Pinto, 1916, (C. N. Ainslie), [all U.S.N.M.].

WASHINGTON: 12♀, 41♂, Wawawai, May 3–July 1901, 1909, 1914, 1915, 1920, (Piper, W. M. Mann, W. A. Yothers), [W.S.C., Ill., D.T.R.]. 2♀, Pullman, May–June 13, 1915–1921, (Lyle Davison, W. A. Yothers), [W.S.C.].

WISCONSIN: 2♀, 1♂, Milwaukee, June 20, 1904, (S. Graenicher in part), [U.S.N.M., 1♂, 1♀, type and paratype of *C. graenicheri*]. 1♀, Milwaukee County, June 23, 1902, (C.E.Br.), [I.U.].

CANADA: 3♂, 24♀, Awema, Manitoba, June 30–July 9, 1908, 1916, 1924, 1925, 1926, (Criddle, K. D. Bird), [U.S.N.M., B.M.N.H., Ill., D.T.R.]. 2♀, Winnepeg, Alberta, July 1, 1921, (A. V. Mitchener), [U.S.N.M.]. 1♂, 6♀, Saskatoon, Saskatchewan, June 11–29, 1923 & 1924, (H. M. King); 2♀, 1♂, Swift Current, Saskatchewan, June 22–July 1, 1931 & 1933, (H. M. King), [Sask., D.T.R.]. 250♀ 150♂, Lethbridge, Alberta, 1935, (H. L. Seamans), [Ill., D.T.R.]. 1♀, Souris, Manitoba, June 25, 1896, [I.U.]. 1♂, Gull Lake, Alberta, June 24, 1929, (E. H. Strickland), [Ill.]. 1♀, Vernon, British Columbia, June 13, 1934, (G. P. Hopping), [Dom.].

*Life History.*—The biology of this species has been studied by a number of workers in North America. The two most comprehensive studies are by the late C. N. Ainslie[48] of the United States Bureau of Entomology and the late Norman Criddle[49] of the Entomological Branch, Department of Agriculture, Dominion of Canada. The following notes on the life history of this species are abstracted from these two papers.

In Utah the adults appear the latter part of April, while Criddle reports them first flying during the second week of June in Saskatchewan. Mating takes place soon after emergence and lasts about one minute. Oviposition takes place soon afterward. The egg is deposited in a similar manner to that of *C. pygmaeus*, but according to Ainslie, it is usually placed in the stem about an inch below the second node from the top. Like that of *C. pygmaeus*, it is decidedly crescent-shaped when first laid, is milky white and glassy in appearance, symmetrical, and marked by faint, short, longitudinal lines of wrinkles. Each female deposits about 50. They vary in size depending upon the size of the female, measuring 1.0 to 1.25 mm. in length and are about one-third as broad. After the first day they lose their crescent shape and become reniform or oval, and hatch in about a week into small larvae with large heads and powerful mandibles. There are apparently four or more molts but this is difficult to determine because of the larval habit of traversing the stem several times during the season. The length of the active larval period is probably about 60 days. Mature larvae vary from 8.0 to 14.0 mm. in length and from 1.0 to 2.0 mm. in diameter.

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[48] U.S.D.A., Tech. Bull., n°. 157, pp. 1–23, (1929).

[49] Can. Dept. Agr. Pamphlet n°. 6, n.s., pp. 1–8, (1924).

When the larva matures it places a plug of frass in the stem about an inch above the ground. Below this plug it cuts a V-shaped groove entirely around the inside of the stem, leaving only the epidermis uncut so that the stem is easily broken off in the wind. Below this cut the larva places another mass of frass, completely plugging the stem. The upper surface of the lower plug is slightly concave and the lower surface smooth. The hibernation cocoon is attached to the lower surface of the plug. When the stem breaks over, the edge is smooth as contrasted with the rough edge left in the stubble infested by *C. pygmaeus.*

Pupation takes place in the early spring about two weeks before the adults emerge.

Hosts.—The native hosts of this species were apparently wild grasses but with the introduction of cultivated grains and grasses the species has gradually adopted these new hosts, while still retaining a number of the original wild ones. This species has been recorded from two species of *Elymus,* six species of *Agropyron,* and from *Hordeum, Bromus, Phleum, Deschapsia, Calamagrostis, Festuca,* as well as timothy, wheat, barley, spelt, and rye.

**Cephus clavatus** (Norton)

1869. *Phylloecus clavata* Norton, Trans. Amer. Ent. Soc., II, p. 345.
1887. *Cephus clavatus* Cresson, Synops. Hym., p. 172.
1898. *Calameuta clavatus* Konow, Ent. Nachr. XXIV, p. 77.

This species may be distinguished from the other members of the genus by the shape of the left mandible (Fig. 33) in both sexes, and in the male by the ornamentation of the seventh abdominal sternite (Fig. 9), as well as by the genitalia (Fig. 4).

It will be noted that Cresson first placed this species in the genus *Cephus* in 1887. It was then changed to *Calameuta* by Konow in 1898, where it has remained until now.

*Characteristics.* — Black except spot at base of mandibles, variably sized spot on clypeus, and spot on mesepisternum below fore wings; legs mostly yellow.

♀. Head transversely quadrate, concave behind; vertex rather densely covered with setiferous punctures, shining; postocellar line about equal to ocellocular line; lateral ocellar line slightly less than diameter of posterior ocelli; a distinct narrow depression laterad and caudad of posterior ocelli; ocellar basin shallow, shining, impunctate; front slightly raised between antennae, shining, and with scattered setiferous punctures below antennae; tentorial fovae prominent with slight depression running towards base of antennae; antennae 21-segmented, slender to ninth segment, subclavate to apex, black, becoming slightly ferruginous toward tip; clypeus asymmetric with yellow spot; mandibles yellow at base, apices rufous, bidentate with inner tooth smaller than outer one and distinctly shouldered (Fig. 33).

Pronotum slightly concave in front, its anterior margin distinctly upturned, densely punctate and covered with coarse light brown pubescence; yellow spot on upper for margin of mesepisterum; praescutum and scutum densely punctured, dull; scutellum very sparsely punctured, smooth, shining; membranes of thorax yellow.

Wings smoky hyaline, costa yellow, stigma yellowish brown, remainder of veins brown. Fore and middle coxae and all trochanters black, hind coxae black except yellow line on outer portion; all femora except basal third and small anterior portion of hind, fore and middle tibiae, and basal joint of tarsi yellow; remainder of legs black.

Abdomen compressed, slightly longer than head and thorax together; dark brown except entire second, third, and fifth, lateral margins of sixth and entire apical tergite, yellow; cerci brown; sheath brown, straight, pointed, short, projecting upward at an angle; saw amber.

Length, 10 mm., length of fore wing, 7.5 mm.

♂. Differs from female in following particulars: More yellow at base of mandibles; spot on clypeus larger; fore and middle femora all yellow; hind femora, except small basal and apical portion, and hind coxae yellow, their tarsi brown; lateral margin of first tergite, entire second, third, and fifth, medial, apical, and lateral portion of sixth, medial stripe on seventh, and entire apical, upper margin of first sternite, second, and third, entire fifth, all but basal portion of seventh, and entire ninth, yellow; eighth sternite with mat of fine brown hairs (Fig. 9).

Length, 9.5 mm., length of fore wing, 7 mm.

Both males and females of this species vary greatly in their color patterns. Several males were examined in which the spot on the clypeus was very indistinct, and only a portion of the second, the entire third, and small lateral spots on the fourth and fifth tergites were yellow. Still others showed only small dots of yellow on the abdominal sternites. The same color variation was found in the females. Several females were examined in which all the legs were a light yellowish brown.

This species, according to earlier workers, has but a single pre-apical spur on the hind tibia. However, in examining about seventy specimens of this species it was noted that there may be one or two on each side, or, in some cases, one on one side and two on the other.

*Type.*—A female from San Francisco, California, in the Academy of Natural Sciences of Philadelphia, no. 10351. I have examined this type and it is in good condition.

*Specimens examined:* Total 72; 36♀, 36♂.

CALIFORNIA: 4♀, 3♂, "Cal.", [A.N.S.P., 1♀, paratype *clavata*]. 1♀, San Francisco, [A.N.S.P., type of *Phylloecus clavata*]. 1♂, "Calif", (C. V. Riley); 1♀, "S.Cal.", [A.N.S.P.]. 1♂, Oakland County, April 17, 1915; 1♀, Lagunitas, Marin County, May 11, 1924, (E. P. VanDuzee), [U.Cal.]. 1♂, Mountains near Claremont, (Baker), [C.U.]. 2♂, Mark West Spring, April 17, 1930; 1♂, Keen Camp, Riverside County, June 6–12, 1917, (E. P. VanDuzee); 1♂, Paraiso Springs, Apr. 18, 1932, (L. S. Shavin); 1♂, Mill Valley, Marin County, Apr. 14, 1928, (R. L. Usinger); 1♂, 1♀, South Sonoma County, May 26, 1911; 2♂, Sobre Vista, Sonoma County, Apr. 20, 1910, (J. A. Kusche); 1♀, Banning, May 29, 1928; 1♂, Nevada City, May 16, 1930, (E. C. VanDyke); 1♀, Pasadena, May 7, 1917, (J. O. Martin); 1♀, Shasta Springs, June 17, 1930, (C. L. Fox); [all C.A.S.]. 5♀, 4♂, Glenwood, St. Cruz Mts., May 1907, [C.U., B.M.N.H., D.T.R.]. 1♀, Catalina Island, (Baker), [C.U.]. 1♀, Lake County; 1♂, 1♀, Redlands, (F. R. Cole); 1♂, Berkeley, July 20, 1919, (M. C. Lane); 1♀, St. Cruz Mts.; 1♂, Mt. View, (Riley); 1♂, Dunsmuir, (Wickham); [all U.S.N.M.]. 2♀, Felton, Santa Cruz Mts., May 1907, [D.T.R.]. 2♂, Portola, June 5, 1915, (M. C. VanDuzee), [I.U.].

IDAHO: 1♂, Lake Wawa, 1930; 2♀, 2♂, Juliaetta, June 5–16, 1930 & 1936, (J. M. Aldrich, R. E. Miller), [Ida., U.S.N.M.]. 1♂, Moscow, (C.V.Riley), [U.S.N.M.] 1♀, Lewiston, May 11, 1935, (W. F. Harper), [Ida.].

OREGON: 1♂, Alsea Mount; 1♀, Albany, May 5–19, 1931, (J. Wilcox); 1♂, Forest Grove, June 16, 1930, (Joe Scuh); 2♀, 3♂, Corvallis, May 18, 1929, (H. A. Scullen); [all Ore.].

WASHINGTON: 1♀, "Eastern Washington", [Ill.]. 1♀, Wawawai, June 1, 1933, (R.D.Shenefelt); 1♂, Dayton, June 1932, (L. Turner); [all W.S.C.]. 4♀, Pullman, June 1921 & 1930, (B.H.Starcher, J.F.G.Clarke), [U.S.N.M., W.S.C., D.T.R.]. 1♂, Almata, [W.S.C.].

*Locality unknown:* 2♀, [U.S.N.M., A.N.S.P.].

*Life History.*—The biology and immature stages as well as the food plants of this species are unknown. However, from a study of the habitat in which the specimens have been collected it seems probable that the larvae will be found feeding in grasses, as do the other members of the genus.

### Subgenus **TRACHELUS** Jurine

1801. *Astatus* Panzer, Faun. Germ. Insect., heft 83, pl. 12, (Genotype: *Sirex troglodyta* Fabricius, by subsequent designation of Rohwer.)[50] 1911.) [Name *Astatus* preoccupied by Latreille 1796.]

1807. *Trachelus* Jurine, Nouv. Meth. Class. Hymen. d. Dipt., p. 70. (Genotype: *Sirex tabidus* Fabricius. Monobasic.)

1820. Cepha, Billberg, Enum. Insect., p. 98. (Genotype: *Sirex tabida* Fabricius. Monobasic.)

1915. *Trachelastatus* Morice and Durrant, Trans. Ent. Soc. London, 1914, p. 383. (New name for *Cepha* Billberg.)

*Astatus* Panzer, July 1801, here placed as a synonyn of *Trachelus* Jurine 1807, is not the same as *Astatus* Jurine, May 1801 as indicated by many authors. Panzer's genus has *Sirex troglodyta* Fabricius as the only included species and this species is therefore the monotypic genotype. However, as has already been shown (p. 272) the name *Astatus* is preoccupied by Latreille 1796. *Trachelus* Jurine 1807, which is also monobasic, becomes valid with *Sirex tabidus* Fabricius as its genotype. *Cepha* Billberg 1820 contained but a single species, *Sirex tabida* Fabricius. This genus is monobasic and isogenotypic with *Trachelus* Jurine. Morice and Durrant proposed the name *Trachelastatus* to replace it. They included only *Sirex tabidus* Fabricius in their new genus. It is therefore monobasic and isogenotypic with *Trachelus* Jurine.

*Trachelus* may be distinguished from *Cephus* by the ornamentation of the seventh and eighth abdominal sternites (Fig. 10) and the genitalia (Fig. 3) in the male. There is also a slight difference in the left mandible in both sexes (Fig. 36). The female is difficult to distinguish from *Cephus* except in color and the slight difference in the left mandible as mentioned above. A character heretofore used by authors was the widening of the tip of the saw-sheath. This has been found unreliable.

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[50] U.S.D.A., Bur. Ent., Tech. Bull., ser. 20, pt. 2, p. 74, (1911).

This subgenus is represented by the imported Black Grain-stem Sawfly, *Cephus tabidus* (Fabricius), in the nearctic fauna.

**Cephus tabidus** (Fabricius)

1775. *Sirex tabidus* Fabricius, Syst. Entom., p. 326, no. 8.
1785. *Tenthredo longicollis* Fourcroy, Entom. Paris, II, p. 378, no. 45.
1790. *Sirex tabida* Gmelin, Linne Syst. Nat., ed. 13, I, p. 2674, no. 18.
1803. *Astatus tabidus* Klug. Monogr. Siric. German., p. 56, no. 8.
1804. *Cephus tabidus* Fabricius, Syst. Piez., p. 252, no. 6.
1807. *Trachelus tabidus* Jurine, Nouv. Meth. Class. Hymen., p. 72.
1820. *Cepha tabida* Billberg, Enum. Insect., p. 98.
1823. *Cephus mandibularis* Lepeletier, Monogr. Tenthred., p. 19, no. 54.
1823. *Cephus nigritus* Lepeletier, Monogr. Tenthred., p. 20, no. 55.
1878. *Cephus vittatus* A. Costa, Atti. Acad. Sci. Fis. Napoli, VII, pt. 2, p. 14.
1900. *Calamenta johnsoni* Ashmead, Ann. Rept. St. Bd. Agr. N. J., Suppl. 1899, p. 600. [Ms. name, misspelling for *Calameuta*.]
1903. *Calameuta johnsoni* Ashmead, Canad. Ent., XXXV, p. 233.
1914. *Cephus pygmaeus* Cory (nec Linnaeus) Rept. Md. St. Hort. Soc., XVII, p. 106.
1915. *Trachelastatus tabidus* Morice & Durrant, Trans. Ent. Soc. London, 1914, p. 383.

This species may be easily distinguished from the other members of the genus by its color, which is constant.

The synonymy given above for *Cephus tabidus* (Fabricius) has not been checked by the author prior to 1900. It has been taken from the work of Gahan[51] on this species. I have, however, checked the descriptions of all the species included in the synonymy and found that they agree with specimens of this species.

*Characteristics.*—Black except base of mandibles, inner side of fore trochanters, tibiae, and tarsi, inner apical portion of middle trochanter, inner side of middle tibiae, and lateral line of spots on first to eighth abdominal tergites, yellow. Left mandible tridentate with two large, subequal, outer teeth and a smaller tooth between that is more or less attached to the inner tooth (Fig. 36).

♀. Head black, transversely quadrate; vertex shining with many setiferous punctures; postocellar line about equal to ocellocular line; lateral ocellar line greater than the diameter of posterior ocelli; a shallow, shining, impunctate depression latero-cephalad of posterior ocelli; ocellar basin T-shaped with base of T projecting toward antennae; front distinctly raised between antennae; antennae clavate beyond ninth segment, dark at base,

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[51] U.S.D.A., Bull. no. 834, pp. 7–8, (1920).

slightly lighter beyond middle, 23-segmented; front shining, sparsely punctured; basal half of mandibles yellow, remainder mahogany brown; palpi brown.

Pronotum distinctly wider than long, slightly concave on front margin, rear margin with deep, rounded concavity, distinctly roughened with numerous setiferous punctures; praescutum and scutum with coarser punctures; mesepisternum with evenly scattered punctures and covered with light pubescence; scutellum smooth, shining, impunctate in center, lateral and basal margins with scattered punctures.

Wings deep smoky hyaline with violaceous reflections; all veins dark brown. Legs black except inner apical half of fore and inner apical spot of middle femora, inner sides of fore and middle tibiae, inner portion of fore tarsi near base, yellow.

Abdomen black except lateral row of yellow spots on lateral margins of segments two to seven, upper apical margin of seventh sternite, a line along margin of eighth sternite to base of saw-sheath; cerci and sheath black, latter sometimes widened at tip when viewed from above, straight, narrow, and bluntly pointed; saw amber to red.

Length, 9.0 mm., length of fore wing, 7.3 mm.

♂. Similar to female except in following particulars: Inner side of fore and middle femora, tibiae, and tarsi (except apical joint), bright yellow; yellow spots on sixth and seventh abdominal tergites smaller; a narrow marginal band on apical portion of last tergite yellow; sixth and seventh abdominal sternites distinctly widened and flattened and each bearing a deep, semi-circular concavity filled with long, needle-like setae (Fig. 10); penis valves nearly as long as claspers, bluntly pointed and slightly tapered at apex (Fig. 3).

Length, 8.75 mm., length of fore wing, 6.5 mm.

This species varies a great deal structurally in the number of pre-apical spurs on the hind tibiae. Previous authors have considered *tabidus* to have two pre-apical spurs on each. However, in examining a number of specimens from this country as well as a small number from Europe, this character was found to be most variable, just as in the other members of the genus. Eighty-eight specimens collected in Pennsylvania, Maryland and Virginia were examined. Thirty-four possessed two pre-apical spurs on each 29 possessed but a single spur on each, and the remaining 25 had one spur on one side, and two on the other. There was very little difference between the sexes in this variation.

*Type.*—The type of this species has not been seen by me. According to Fabricius[52] the type is in the Banks collection in the British Museum.

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[52] Syst. Piez., p. 252, n. 6, (1804).

*Distribution.*—This species is found throughout most of the middle and southern countries of Europe, southeastern Asia, and northern Africa, and has been recorded from Delaware.[53] It has been seen by the author from the following of the United States.

*Specimens examined:* Total 175; 116♀, 59♂.

MARYLAND: 1♂, 1♀, Hagerstown, May 15, 1915, (W. R. McConnell), [C.U.]. 9♂, Wolfsville, June 1, 1914, (W. R. McConnell, Hyslop), [C.U., U.S.N.M.]. 30♀, "Maryland", [U.S.N.M.].

NEW JERSEY: 1♀, Riverton, May 29, [U.S.N.M., type of *Calameuta johnsoni*].

NEW YORK: Larvae found in wheat stubble, Milo, Yates County, July 1925, (D. T. Ries), [D.T.R.].

OHIO: 8♀, 3♂, Ellsworth, June 8, 1934, (J. S. Houser), [D.T.R.]. 7♀, 3♂, Wooster, June 1935, (J. S. Houser), [B.M.N.H., D.T.R.].

PENNSYLVANIA: 1♂, 2♀, Carlisle, 1925, (D. T. Ries), [B.M.N.H., D.T.R.]. 1♀, Somerset, June 18, 1935; 1♀, Gladys Run, June 22, 1924, (Homer C. Will), [H.C.W.]. 1♀, 1♂, Eberly Mill, June 7, 1908, [K.U.]. 1♀, 1♂, York, June 14, 1917, (J. L. King); 1♀, Charter Oak, June 20, 1917, (H. B. Kirk); 1♀, 1♂, Lancaster, May 22–June 7, 1921 & 1922, (F. M. Trimble); 3♀, Harrisburg, June 7–20, 1908, 1920, 1921, (A. B. Champlain in part); 4♂, 2♀, Hummelstown, May 7, 1921 & 1926, (J. M. Knull); 1♀, Mechanicsburg, June 10, 1908; 1♀, Progress, June 11, 1922, (F. M. Trimble); [all Penn.]. 1♀, Herdon, June 6, 1907, [U.S.N.M.]; 11♀, Linglestown, June 3, 1919 in part, (A. B. Champlain in part), [U.S.N.M., Penn.].

VIRGINIA: 40♀, 30♂, Dayton, May 27–June 16, 1931, 1932, 1935, (Homer C. Will), [H.C.W., B.M.N.H.]. 5♂, 2♀, Warrenton, May 30, 1928 (L. C. Woodruff), [K.U.].

*Life History.*—The life history of this species has been observed both in this country and Europe. Gahan[54] published a paper on this insect soon after its introduction into this country in 1918 and since then considerable work has been done on its biology at the United States Entomological Laboratory at Carlisle, Pennsylvania. While associated there with the late P. R. Myers of the United States Bureau of Entomology the author did considerable biological work on the species. A résumé of this work follows.

The adults appear in the field soon after the first of May in southern Pennsylvania and are at large until the latter part of June. Mating takes place soon after emergence and the female inserts the egg in the stem just below the growing tip. The eggs are milky white in color, oblong, and slightly covered. They average about 1.1 mm. in length with an average maximum width of about 0.45 mm. and an average minimum width of 0.42 mm.

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[53] U.S.D.A., Bull. 834, pp. 4–5, (1920).

[54] U.S.D.A., Bull. 834, pp. 1–18, (1920).

The larva when first hatched measures 1.75 mm. in length. Its large chitinous head is equipped with large-toothed mandibles, which, with the chitinous dorsal horn, are its only means of locomotion, since it is footless. The habits of the larva are very similar to those of *pygmaeus* and *cinctus* which have already been described. It begins almost immediately after hatching to feed on the delicate parenchymatous tissue lining the inside of the stem. As it reaches a node it excavates a tunnel through it and goes on to the next. The larva apparently traverses the tunnel several times during the season as a number were found with frass both above and below them. They are apparently four instars. The larva feeds about a month before it compacts a mass of frass within the tunnel about one and a half to two inches above the ground. Just below this plug the larva cuts a V-shaped groove completely around the inside of the culm, leaving but a thin layer of epidermis uncut. Just below the V-shaped cut it places another plug of frass. This lower plug is flat across the top as compared with the concave upper surface formed by *pygmaeus*. The groove between the plugs allows the stem to break over. Below the second plug the larva spins its silken hibernation cocoon, which is free from the sides of the stem but attached to the lower surface of the plug.

The mature larva is subcylindrical, yellowish white in color, and measures 7 to 9 mm. in length. The head is pale yellow, its dorso-ventral length about 1.1 mm. and its breadth about the same. The antennae are 5-segmented, tapering at the apex, and more or less fuscous in color. The mandibles are 4-toothed and brown, with apices black. The labrum, sutures about clypeus, and articulations are brownish. Vestiges of thoracic legs are small, papilliform, and pale brown. The dorsal abdominal segments are triannulate; pleura prominent, ventral segments triannulate; prolegs absent; dorsal anal lobe viewed from the side not triangular, not sloping gradually from base to apex but convexly rounded, with posterior end of lobe as thick dorso-ventrally as the anterior end, and nearly perpendicular (Fig. 69). Anal prong short, about as long as wide, completely encircled by two irregular rows of widely separated, stiff, short spines which do not arise from chitinized turbercles; eighth and ninth tergites with transverse row of distinct hairs.

Pupation takes place early in the spring about two weeks before the adults emerge.

*Hosts.*—This species has been recorded infesting wheat and rye in this country. It is not unlikely that it will also be found in some of the grasses having large stems such as *Bromus, Elymus,* and *Agropyron,* or any of the cultivated or wild grasses whose seasonal development will provide stems of sufficient size to accommodate the larvae during their active feeding period.

### **JANUS** Stephens

1835. *Janus* Stephens, Illus. Brit. Entom. Mandib., VII, p. 107. (Genotype: *Janus connectens* Stephens, by subsequent designation of Westwood[55] 1840.)

1838. *Phylloecus* Newman, Ent. Mag., v, p. 485. (Genotype: *Phylloecus faunus* Newman. Monobasic.

1860. *Ephippionotus* O. Costa, Fauna del Regno Napoli, Cephidae, p. 11. Genotype: *Ephippionotus luteiventris* O. Costa = *Janus compressus* (Fabricius). Monobasic.

GENOTYPE: *Janus connectens* Stephens 1835, by subsequent designation of Westwood[55] 1840. The type of this species is in the British Museum. It has been examined for me by Mr. Robert B. Benson of that institution, who, in a personal communication, says that *connectens* Stephens is without doubt a synonym of *Janus luteipes* (Lepeletier)[56] 1823.

There seems to be some confusion concerning the identity of this genotype. Authors following Westwood[55] have synonymized *connectens* Stephens[57] with *femoratus* Curtis.[58] It seems without doubt that this synonymy is incorrect. In Curtis' description and figures of *femoratus* he gives the left mandible as tridentate, the tarsal claws as " long, slender, and bifid near

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[55] Synop. Gen. Brit. Ins., App., p. 55, in Intro. Mod. Class. Ins., II, (1840).

[56] Monogr. Tenthr., p. 20, no. 56, (1823).

[57] Illus. Brit. Entom. Mandib., VII, p. 108, pl. 36, fig. 1, (1835).

[58] Brit. Ent., VII, p. 301, no. 10, (1830).

apex", and figures the antenna as being distinctly clavate beyond the fifth segment. I have not been able to examine the type of *femoratus* which is now deposited in the National Museum, Melbourne, Australia, but Mr. J. Clark of that museum has very kindly examined the Curtis type as well as two specimens of *connectens* which are also in the Curtis collection, and forwarded sketches and notes on both species to me.

In Stephen's description of his new genus *Janus* he states that the left mandible is bidentate and the antenna is long and filiform. In *Janus* the tarsal claws are short, stout, and strongly curved (Fig. 61), very unlike those described and figured in Curtis' description of *femoratus,* which corresponds to the claws found in *Cephus* (Fig. 66).

A comparison of the published descriptions of these two species seems to verify the fact that *femoratus* Curtis has been incorrectly placed in *Janus* as a synonym of *connectens* Stephens, but should undoubtedly be placed in *Cephus.*

When Newman erected the genus *Phylloecus* [59] he questioned Stephen's placing of *Cephus femoratus* Curtis in the genus *Janus,* and pointed out certain discrepancies between the two species that have just been discussed. He did not examine the type of Curtis' species, but did see the type of Stephens' species.

Rohwer [60] gives *Janus connectus* (sic) Stephens as the genotype of *Janus* as does Cameron,[61] but states further that *Janus cynosbati* (Fabricius) is also a synonym of *connectens.* However, *cynosbati* is a Linnean species and in 1883 Möller [62] pointed out that *Tenthredo cynosbati* Linnaeus was in reality a *Pimpla.* The *cynosbati* Linnaeus discussed by Konow [63] was undoubtedly a misidentified specimen. Enslin [64] has also synonymized *connectens* Stephens with *femoratus* Curtis, as does Benson,[65] without having seen the type of the latter.

[59] Ent. Mag., v, pp. 485–486, (1838).

[60] U.S.D.A., Bur. Ent., Tech. Ser. Bull. 20, pt. 2, p. 81, (1911).

[61] Monogr. Brit. Phytoph. Hym., III, p. 118, (1890).

[62] Ent. Tidskr., IV, p. 91, (1883).

[63] Zeit. Syst. Hym. u. Dipt., IV, p. 244, (1904).

[64] Deutsch. Ent. Zeitschr., p. 692, (1917).

[65] Ann. and Mag. Nat. Hist., (10), XVI, p. 545, (1935).

*Characteristics.*—Head transversely quadrate to subglobose; front produced between antennae; antennae nearly filiform (Fig. 59), 25- to 28-segmented; clypeus asymmetric, lobe distinctly angulated on left, usually rounded on right side (Fig. 47); first marginal cell of fore wings usually narrower at base and along stigma than at apex; base of radial vein often atrophied near stigma (Fig. 54); wings may have fuscous markings (Figs. 53 & 55); hind tibiae with one or two pre-apical spurs; hind tarsal claws short, thick, with two subequal teeth at nearly right angles to claw, and also a large basal lobe present (Fig. 61); abdomen compressed, only about one-third longer than the head and thorax together; left mandible bidentate with inner tooth shouldered and broad at base (Fig. 23); basal segment of posterior tarsi equal in length to remaining tarsal segments combined. Female: cerci slender; sheath long, slightly curved downward, bluntly pointed (Fig. 24); teeth of lance small rounded; teeth of lancet large, incudiform (Fig. 35). Male: penis valves short, obliquely truncate with small median projection, shorter than claspers and without tubercles (Figs. 18 & 19).

## *Key to North American Species of Janus*

1. Base of radial vein atrophied near stigma (Fig. 54)..................2
   Base of radial vein present (Fig. 55)..................................3
2. Wings entirely hyaline..............................*abbreviatus* ♂ ♀
   Wings entirely hyaline except for two round fuscous spots, one each in fourth submarginal and second apical cells of fore wing (Fig. 53). *bimaculatus* ♂
3. Hind tibiae with two pre-apical spurs; abdomen black or orange.......4
   Hind tibiae with one pre-apical spur; abdomen entirely red; wings somewhat infuscated toward tips and along veins........*rufiventris* ♀
4. Wings with one fuscous spot, below stigma (Fig. 55).......*integer* ♂ ♀
   Wings with two round fuscous spots, one each in fourth submarginal and second apical cells of fore wings................*bimaculatus* ♀

**Janus abbreviatus** (Say)

1824. *Cephus abbreviatus* Say, Keating's Narrat. Exped. St. Peter's Riv., II, p. 314. (♀.)

1837. *Xiphydria basalis* Say, Bost. Jour. Nat. Hist., I, p. 222. [New synonymy.]

1861. *Cephus heteropterus* Norton, Proc. Bost. Soc. Nat. Hist., VIII, p. 224. (♂.)

1888. *Phylloecus integer* Riley, Ins. Life, I, p. 8. (♂, ♀.)

1888. *Cephus interruptus* Provancher, Add. Faun. Hym. Can., p. 355. (♂, ♀.)

1904. *Janus abbreviatus* Konow, Zeit. Syst. f. Hym. u. Dipt., IV, p. 119. (♂, ♀.)

The adults of this species are easily separated from the other species of the genus by the clear hyaline wings which have the base of the radial vein atrophied. One other species, *Janus bimaculatus* (Norton), has the base of the radical vein atrophied in the male only, but may easily be distinguished from *abbreviatus* by the presence of two found fuscous spots in each fore wing.

*Characteristics.*—Black; base of abdomen of female, most of legs except hind tarsi of male and tibiae and tarsi of female reddish yellow; wings hyaline, base of radial vein near stigma atrophied.

♀. Head black, subquadrate; vertex minutely and sparsely punctured posteriorly, smooth, polished, and impunctate near ocelli; postocellar line about equal to ocellocular line; lateral ocellar line less than diameter of posterior ocelli; ocellar basin long and narrow; front raised and bluntly carinate between antennae; antennae slightly and evenly thickened, but not clavate, longer than head and thorax together, 26-segmented; mandibles white, tips rufous; palpi pale yellowish white.

Pronotum shining, polished, impunctate; posterior margin white; praescutum and scutum regularly punctured by well seperated punctures; scutellum sparsely punctured, somewhat shining; mesepisternum impunctate; mesoventer with longitudinal yellowish brown stripe; mesopleurae with longitudinal white triangle; scutellum with transverse white line; metapleurae with median yellowish brown stripe; basal plates with lateral yellowish brown spot.

Wings entirely hyaline, without violaceous reflections; veins brown except costa which is yellowish; base of radial vein broadly interrupted near stigma (Fig. 54). Fore and middle coxae, except base, and hind coxae yellow; all trochanters, femora, fore and middle tibiae, and tarsi yellow; fore and middle claws and last tarsal segment brown; base of fore tibiae whitish; basal third of hind tibiae white; remainder of legs brown; apical and pre-apical spurs yellowish brown.

Abdomen compressed; first two tergites and sternites entirely, third sternite except median basal brown spot, and extreme lateral and anteriolateral margins of third tergite, yellow to reddish yellow; remainder of abdomen including sheath and cerci black; saw amber.

Length, 9.5 mm.; length of fore wing, 7.5 mm.

♂. Resembles female except for the following particulars: Abdomen not compressed, brownish black except first two sternites reddish yellow; no yellowish brown stripes on metapleurae or mesoventer; fore coxae except bases, and trochanters, bases and apices of femora, all tibiae and tarsi, white; apical two-thirds of hind tibiae brownish, their tarsi pale brown, except last segment and claws.

Length, 8 mm.; length of fore wing, 6 mm.

*Type.*—The type of this species is apparently no longer in existence, but specimens from the type locality, " Pennsylvania," have been examined.

*Cephus heteropterus* Norton [66] is in the Harris collection in the Boston Society of Natural History, Boston, Massachusetts. I have not examined it but specimens have been compared with a cotype by Dr. Richard Dow of that Institution. They agree in all respects with specimens of *Janus abbreviatus* (Say) and with Say's original description of his species. Rohwer [67] states, " The type is lost, but a paratype which lacks the head and has part of the thorax eaten away is in the Harris collection under no. 314, —". Dr. Dow, in a personal communication says, " According to Harris's manuscript catalogue, this specimen was collected in Dublin, N. H., and came from Mr. Leonard. It is a male, and now consists of the left wings, and portions of the thorax, abdomen and legs."

*Xiphydria basalis* Say is given here for the first time as a synonym of *Janus abbreviatus* (Say). The type of this species is, of course, no longer in existence. This synonymy is based entirely upon Say's original description. In studying the nearctic Xiphydriidae no specimen has been found that would fit Say's description of *basalis*. However, using the color of the mandibles and palpi, as well as the color description of the abdomen and the fact that Say mentioned that *basalis* has the " first cubital cellule confluent with first radial, having only rudiment of the dividing nervure ", there seems to be no doubt but that *Xiphydria basalis* Say is synonymous with *Janus abbreviatus* (Say).

*Phylloecus integer* Riley (not Norton) [68] is a misdetermination by Riley of *Janus abbreviatus* (Say). The figures and descriptions given in Riley's article definitely show that he was dealing with *abbreviatus*.

*Cephus interruptus* Provancher is also a synonym of *abbreviatus* (Say). I have not examined Provancher's type in the Provincial Museum, Quebec, but the original description leaves no doubt but that his is conspecific with Say's species. Mr. Rohwer has examined the type and says[69] that it is a female, and bears a yellow label no. 1542 and is in the "2nd Coll. Pub. Mus., Quebec." The head is missing.

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[66] Proc. Bost. Soc. Nat. Hist., VIII, p. 224, (1861).

[67] Jour. Wash. Acad. Sci., X, p. 515, (1920).

[68] Ins. Life, I, pp. 8, (1888).

*Specimens examined:* Total 90; 57♀, 33♂.

CONNECTICUT: 1♂, Derby, June 7, 1917; 2♂, 1♀, Durham, Aug. 26–30, 1925, (M. P. Zappe), [Conn.].

DISTRICT OF COLUMBIA: 12♂, 12♀, Apr. 10–Aug. 20, 1893, 1894, & 1895, (C. V. Riley in part), [U.S.N.M.]. 2♂, May 5, 1893, [A.N.S.P.].

ILLINOIS: 1♀, Algonquin, (Nason); 1♀, Pulaski, May 25, 1932, (H. L. Dozier), [Ill.].

MAINE: 1♀, Eastport, July 1912, [B.S.N.H.].

MASSACHUSETTS: 1♀, Somerset, July 6, 1907, [B.S.N.H.]. 1♀, Sherborn, July 25, 1904, [U.I.].

MICHIGAN: 1♀, Douglas Lake, Aug., (C. H. Kennedy), [O.S.U.]. 1♀, "Ag. Coll., Mich.", July 5, 1892, [U.S.N.M.].

NEW JERSEY: 6♀, New Brunswick, June 10–17, 1916, (H. B. Weiss), [U.S.N.M.]. 1♀, New Brunswick, June 31, [sic] 1916, (H. B. Weiss), [U.S.N.M.].

NEW YORK: 2♀, Oneonta, July 7, 1935, (H. K. Townes, jr.), [H.K.T., D.T.R.]. 3♀, Ithaca, June 24–Aug. 24, 1894, 1905, & 1907, (R. H. Pettit in part); 1♂, Ellis-Slaterville, June 13, 1904, [C.U., B.M.N.H.]. 1♀, Greene, (L. O. Howard), [U.S.N.M.]. 1♀, Albany, June 14, 1912; 1♂, Clinton, June 13, 1908, [N.Y.S.].

PENNSYLVANIA: 1♀, North East, June 16, 1916, (R. A. Cushman); 1♂, Highspire, June 6, 1908, (P. R. Myers), [U.S.N.M.]. 3♂, 2♀, Harrisburg, June 11–13, 1908, 1918, & 1922, (P. R. Myers, A. B. Champlain in part), [Penn., D.T.R.]. 1♀, Jeanette, (H. G. Klages), [Ill.].

VIRGINIA: 1♀, Arlington, May 9, 1910, (C. H. Popenoe), [U.S.N.M.].

WISCONSIN: 1♂, Dane Co., June 2, 1913, (W. S. Marshall); 1♂, Milwaukee, [U.S.N.M.].

CANADA: 1♂, (C F. Baker), [U.S.N.M.]. 1♀, Grand River, Nova Scotia, July 23, 1931, (M. L. Prebble); 1♀, Aweme, Manitoba, July 20, 1917, (N. Criddle); 1♂, 1♀, "Eastern Ontario", [C.N.C.]. 10♀, 5♂, St. Williams Port of Ontario, May 24–June 21, 1924, [U.S.N.M.]. 1♀, Edmonton, Alberta, July 11, 1923, (E. H. Strickland); 1♀, St. Andrews, Quebec, June 10, 1933, (O. Peck); 1♀, Aylmer, Quebec, July 22, 1924, (C. B. Hutchinson), [C.N.C.]. 2♀, Knowlton, Quebec, July 11, 1936, (G. S. Walley), [C.N.C., D.T.R.]. 1♂, Parry Sound, Ontario, July 14, 1932, (G. S. Walley), [C.N.C.].

*Life History.*—The biology of this species is fairly well known, having been studied by C. V. Riley[70] and by a number of other workers since that time. Riley gives the life history under the name *Phylloecus integer* Norton, but as has already been pointed out, this was a misdetermination for *Janus abbreviatus* (Say).

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[69] Can. Ent., XLIX, p. 335, (1917).

[70] Ins. Life, I, p. 8, (1888).

The adults appear soon after the middle of April and are at large until the early part of June in the vicinity of Washington, D. C. Soon after emerging the females deposit their eggs in the growing tips of willow and poplar. They are about 1 mm. long, polished, elongate, oval, and slightly curved, with one end more or less pointed. They are inserted in an oblique position in the pith from two to six inches below the tip. After depositing the egg the female girdles the twig about an inch above the oviposition puncture, in order to protect the egg from being crushed by further growth of the twig. They hatch in seven to ten days. Soon after being girdled the twig withers and drops to the ground.

The young larva begin boring in the pith soon after hatching, sometimes tunneling a distance of two feet down the stem before reaching maturity. The tunnel behind the larva is entirely filled with frass. Middleton[71] gives a complete description of the mature larva, and only a résumé of it will be given here. It measures 10 to 12 mm. in length, is yellowish white in color, and somewhat enlarged dorsally and laterally in the thorax. The head is chitinized and measures 1.75 mm. in length and 1.50 mm. in width; the mandibles, their articulations, and the labrum are darker than the head and chitinized. The antennae are 5-segmented. The thorax bears three pairs of small mamma-like legs and has faintly yellowish chitinized spots on the pleura. The abdominal segments are distinctly two annulate laterally and with a small annulet dorsally; pleura prominent. The venter is three annulate and with prolegs. The dorsal anal lobe terminates in a prong; the anal plate and ventral lobe are somewhat haired; lateral surface of dorsal anal lobe bare except for two or three prominent hairs and more yellowish than anal plate.

Late in the fall, about November in Washington, D.C., the larva chews a passage through the woody portion of the stem to the epidermis, which is left uncut. It then spins a silken cocoon in the tunnel in which it passes the winter. Pupation takes place about the first of March and this stage lasts about six weeks. There is but a single generation a year.

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[71] Proc. Ent. Soc. Wash , XIX, p. 176, (1917).

**Janus bimaculatus** (Norton)

1868. *Phylloecus bimaculatus* Norton, Trans. Amer. Ent. Soc., II, p. 346. (♂, ♀.)
1874. *Cephus quadriguttatus* Westwood, Thes. Ent. Oxon., p. 111, Pl. 20, fig. 11. (♀.)
1882. *Cephus bimaculatus* Kirby, List Hym. Brit. Mus., I, p. 363.
1904. *Janus bimaculatus* Konow, Zeit. Syst. Hym. u. Dipt., IV, p. 118.

This species, while similar in color to *Janus abbreviatus* (Say) and *J. integer* (Norton), may be easily distinguished from both of them by the two apical round fuscous spots on the fore wings.

*Characteristics.*—Black; female with four basal tergites, all sternites, and legs reddish yellow; male with tergum black, venter reddish; wings of both sexes hyaline with two round fuscous apical spots; base of radial vein atropied near stigma in male.

♀. Head black, subquadrate, sloping slightly behind eyes; vertex minutely and evenly set with setiferous punctures; ocellocular line greater than postocellar line; a slightly depressed impunctate and shining area caudo-laterad of posterior ocelli; lateral ocellar line about equal to diameter of posterior ocelli; front raised between antennae; front and clypeus shining, sparsely covered with minute punctures; clypeus asymmetric, left lobe distinctly angulated near end, right end of lobe rounded (Fig. 47); antennae 25-segmented, third segment longer than fourth, flagellum nearly filiform, tapering slightly at apex; mandibles and palpi yellow, tips of former red.

Pronotum shining, impunctate except lateral third which is evenly and finely punctured; lateral margin translucent and white; praescutum, scutum, and scutellum finely and evenly punctured; mesepisternum evenly covered with fine punctures and light-colored pubescence and with a broad yellow stripe.

Wings hyaline, iridescent, with large round fuscous spot at outer end of fourth submarginal cell, and smaller round spot in middle of second apical cell (Fig. 53); costa and basal portion of stigma yellowish brown; remainder of stigma and veins brown. Bases of coxae and tips of tarsal claws brown; remainder of legs yellow to amber.

Abdomen compressed, first three tergites and sternites entirely, fourth tergite with apical band which is interrupted medially, fourth sternite, lower apical margin of fifth tergite, and apical margin of fifth sternite, orange; remaining abdominal segments, cerci, and sheath black; saw-sheath blunt, short, and slightly curved downward; saw amber.

Length, 10 mm.; length of fore wing, 7 mm.

♂. Differs from female in following details: Mandibles white, tips red; antennae ferruginous below; a white spot on caudo-lateral margins of pronotum; mesepisternum white except upper and front margins; base of radial vein near stigma atrophied; coxae, except bases, and trochanters straw-colored; remainder of legs light amber; abdomen dark brown above, venter reddish.

Length, 6 mm.; length of fore wing, 5.5 mm.

*Type.*—A male collected at Farmington, Connecticut, in the Academy of Natural Sciences of Philadelphia, no. 10350. I have examined it and found it to be in good condition.

The type of *Cephus quadriguttatus* Westwood is a female. It is in the Westwood Collection at Oxford University in England. I have not examined it but the published description and figure[72] leave no doubt that Westwood's species is identical with *Janus bimaculatus* (Norton).

*Specimens examined:* Total 14; 11♀, 3♂.

CONNECTICUT: 1♂, Farmington, [A.N.S.P., Type of *bimaculatus*]. 2♀, Conn., [A.N.S.P.]. 1♀, Mt. Carmel, June 11, 1914, [B.S.N.H.].

ILLINOIS: 1♀, Dongola, May 9, 1916, [Ill.].

MARYLAND: 1♀, Plummer's Island, June 6, 1912, (H.S.Barber), [U.S.N.M.].

MASSACHUSETTS: 1♀, [A.M.N.H.].

MAINE: 1♀, Southwest Harbor, July 10, 1918, [B.S.N.H.].

NEW YORK: 1♂, Ithaca, June 6, 1929, (P. P. Babiy), [C.U.]. 1♀, Otsego Lake, June 25, 1935, (H. K. Townes, jr.), [D.T.R.].

CANADA: 3♀, St. Andrews, Quebec, June 5, 1933, (O. Peck), [C.N.C., D.T.R.].

*Life History.*—Nothing is known of the biology or the food plants of this species.

### Janus rufiventris (Cresson)

1880. *Cephus rufiventris* Cresson, Trans. Amer. Ent. Soc., VIII, p. 33. (♀.)
1917. *Janus rufiventris* Rohwer, Proc. Ent. Soc. Wash., XIX, p. 141.

This species is easily distinguished from the other members of the genus not only on the color of the abdomen but also by the fact that it has but a single pre-apical spur. All other characters of the antennae, tarsal claws, left mandible and shape of the teeth on the saw definitely place it in the genus *Janus*.

*Characteristics.*—Head and thorax black; abdomen red; wings hyaline, slightly infuscated at tips and along some veins.

♀. Head black, transversely quadrate, slightly widened behind eyes; vertex polished and shining with minute scattered punctures; ocellocular

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[72] Thes. Ent. Oxon., p. 111, pl. 20, fig. 11, (1874).

line greater than postocellar line; lateral ocellar line about equal to diameter of posterior ocelli; ocellar basin shallow, longitudinal; front smooth, polished, impunctate, raised to a distinct tubercle between antennae; bases of antennae moderately close together; antennae 25-segmented, third segment slightly longer than fourth; flagellum nearly filiform, tapering slightly at extremity; temples smooth, polished, with only few scattered punctures; clypeus smooth, polished, asymmetric; mandibles yellow at base, tips rufous; palpi light yellowish brown.

Pronotum moderately short and broad, shining, sparsely punctured, caudal margin slightly emarginate; praescutum and scutum with evenly distributed round punctures; scutellum smooth, impunctate, with sparse gray pubescence; thoracic membranes white.

Wings hyaline, slightly infuscated along margins and some veins; costa, stigma and veins brown. Legs blackish brown; outer side of fore tibiae paler; hind tibiae with one pre-apical spur.

Abdomen uniform brick-red to amber; cerci brownish yellow; saw amber.

Length, 8 mm.; length of fore wing, 6 mm.

♂. Unknown.

*Type.*—A female from Napa County, California, in the Academy of Natural Sciences of Philadelphia, no. 534. I have examined it. The left fore wing and left antenna are missing and the right fore wing is glued on the label below the specimen.

*Specimens examined:* Total 4♀.

California: 1♀, Napa County, (H. Edwards), [A.N.S.P., type]. 1♀, Mills Valley, June 7, 1915, (E. P. VanDuzee), [U.Cal.]. 1♀, Sobre Vista, Sonoma County, Apr. 20, 1910, (A. J. Kusche), [C.A.S.].

Oregon: 1♀, Forest Grove, Apr. 27, 1915, (L. P. Lockwood), [U.S.N.M.].

*Life History.*—The biology and host plant of this species are unknown.

**Janus integer** (Norton)

1830. *Cephus filicornis* Harris' MS. catalogue (vide Norton 1861). (♂.)
1832. *Cephus integer* Harris' MS. catalogue (vide Norton 1861). (♀.)
1861. *Cephus integer* Norton, Proc. Bost. Soc. Nat. Hist., viii, p. 224.
1862. *Janus flaviventris* Fitch, 7th Rept. N. Y. Insects, p. 852.
1869. *Phylloecus integer* Norton, Trans. Amer. Ent. Soc., ii, p. 346.
1897. *Janus integer* Slingerland, C. U. Exper. Sta. Bull., 126, p. 41.

This species may be easily distinguished from the other members of the genus by the fuscous spot in the fore wing just below the stigma.

*Characteristics.*—Black; the three basal segments of the abdomen of female and all segments of male, most of legs except hind tibiae and tarsi red or yellowish; wings hyaline with fuscous spot below stigma.

♀. Head black, subquadrate; vertex with two slight longitudinal impunctate depressions behind and slightly laterad of posterior ocelli; mesad of depressions closely and minutely punctured; laterad of depressions not perceptibly punctured; postocellar line about equal to ocellocular line; lateral ocellar line less than diameter of posterior ocelli; no distinct ocellar basin; front raised between antennae forming distinct blunt tubercle; front raised into triangular portion from base of antennae to extremities of clypeus; antennae 28-segmented, nearly filiform and tapering slightly toward apex; mandibles yellow, tips red; palpi yellow.

Pronotum impunctate, posterior margin translucent; mesoscutal lobes with fine, close but not confluent punctures, each lobe having broad longitudinal median impunctate area; praescutum and scutum indistinctly punctured; scutellum with numerous poorly defined punctures; mesepisternum with fine, close, setiferous punctures.

Wings hyaline, without violaceous reflections; costa yellow, stigma dark brown, remaining veins brown; a fuscous spot just below stigma (Fig. 55). Tips of fore coxae, middle of hind trochanter, entire fore and middle legs, and hind femora, yellowish red; base of hind tibiae yellowish white; remainder of hind tibiae and all tarsi brown; all trochanters white beneath; a tendency for whitish to appear on various parts of fore and middle legs in some specimens.

Abdomen compressed; first three tergites and first four sternites entirely and base of fourth tergite red; an obscure reddish spot on fifth sternite; remainder of abdomen, saw-sheath, and cerci black; saw reddish.

Length, 12 mm.; length of fore wing, 9.5 mm.

♂. Differs from female in following particulars: fore and middle legs yellow; tips and bases of posterior tibiae buff; posterior border of pronotum and scutellum yellow; abdomen yellowish red except basal portion of first tergite and first sternite and row of lateral spots brownish.

Length, 9 mm.; length of fore wing, 6 mm.

*Type.*—A female in the Harris Collection in the Boston Society of Natural History, Boston, Massachusetts. It has been examined for me and compared with specimens in my collection by Dr. Richard Dow of that institution, and bears ahe label no. 354. In a personal communication Dr. Dow says, "According to the manuscript catalogue, this specimen came from a window, Cambridge, Mass., June 20, 1832. It is a female in good condition except that the legs are imperfect." This specimen is also referred to by Rohwer[73] as the type. A cotype, according to Dow, bears the label no. 283, was collected in Milton, Massachusetts, September 1830 and now consists of three wings and a portion of the thorax. Rohwer[73] refers to "*Cephus filicornis*, Harris, Cat. Ins. Mass., 584, nomen nudem" as "the specimen Norton examined in connection with his description of *Cephus integer*" and says that the specimen is damaged and bears the number 283 in the Harris collection. Rohwer further states in the same publication that "it is, as stated by Norton, the ♂ of *integer.*"

*Janus flaviventris* Fitch is also a synonym of *integer*. I have been unable to locate the type of this species. There is in the Fitch Collection in the United States National Museum at Washington, D. C., a pin with a portion of a thorax remaining, labelled "*Janus flaviventris*", which may be all that remains of the type. However, Fitch's original description agrees in all respects with specimens compared with Norton's type.

Slingerland[74] placed this species in the genus *Janus* on the basis of Konow's publication[75] of 1896.

*Specimens examined:* Total 46; 28♀, 18♂.

CONNECTICUT: 5♂, 1♀, New Haven, May 6–June 6, 1913, 1916, & 1922, (B. H. Walden), [Penn., U.S.N.M., Conn., D.T.R.]. 1♂, Wallingford, May 24, 1919, (B. A. Porter), [U.S.N.M.].

ILLINOIS: 3♂, 4♀, Algonquin, May 15, 1895 in part, (Nason in part), [Ill., I.U., C.U., D.T.R.]. 1♂, Oregon, June 19, 1917, [Ill.].

IOWA: 1♀, Dickinson County, July 3, 1935, (H. E. Jaques), [Ia.].

MARYLAND: 1♀, Plummer's Island, June 6, 1908, (H.S.Barber), [U.S.N.M.].

MASSACHUSETTS: 1♀, "Mass.", [A.N.S.P.]. 2♂, Nantucket, July 16–22, 1926 & 1927, (C. W. Johnson); 1♂, Auburndale, May 25, 1905; 1♀, Blue Hills, June 16, 1903; [all B.S.N.H.].

MICHIGAN: 1♀, 1♂, Adrian, (J. Wallis), [U.S.N.M.].

MONTANA: 1♂, "Mont.", [A.N.S.P.].

NEW HAMPSHIRE: 1♂, Jaffrey, June 18, 1917, (C.W.Johnson), [B.S.N.H.].

NEW YORK: 5♀, Ithaca, June 2–20, 1900, 1902, 1916, & 1925, (P.P.Babiy in part), [B.M.N.H., I.U., C.U.]. 1♀, Flatbush, [A.M.N.H.]. 1♀, South Byron, May 2, 1883, (J. F. Prose), [C.U.]. 3♀, Corning, May 11–13, 1896 & 1899; 2♀, Troy, Feb. 28–31 (sic), 1913; [N.Y.S.].

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[73] Jour. Wash. Acad. Sci., x, p. 515, (1920).

[74] C. U. Exper. Sta. Bull., 126, p. 41, (1897).

[75] Wien. Ent., Zeit., xv, p. 150, (1896).

OHIO: 1♀, Ashtabula, [U.S.N.M.].

CANADA: 1♂, Aylmer, Quebec, (G. H. Hammond); 1♂, Awema, Manitoba, June 24, 1924, (N. Criddle); 1♀, Gaspé, Quebec, July 9, 1933, (E. B. Watson); [all C.N.C.]. 1♀, Cascapedia, Quebec, July 16, 1932, (C. C. Smith), [Ill.].

*Locality unknown*: 1♀, (?) (as *J. flaviventris*), [U.S.N.M.]. 1♀, [C.U.]. 1♀, [N.Y.S.].

In addition to the localities given, Slingerland[76] reports this species from Rhode Island.

*Life History.*—The biology of this species has been carefully studied by a number of workers. Slingerland[76] gives a very good and complete account of it and a résumé of his work is given here:

The female deposits the eggs soon after the adults emerge, in the latter part of May or early June in New York State in the vicinity of Ithaca. They are laid in the pith several inches below the tips of currant stems; are elongate-oval in shape, yellowish white in color, and about 1 mm. in length. Immediately after depositing the egg, the female girdles the stem about one-half to one inch above the oviposition puncture. Slingerland reports that this girdling is done with the ovipositor and not by means of the mandibles as reported by other workers. The eggs hatch in about eleven days.

Soon after hatching the young larva begins to tunnel downward in the pith and continues tunneling throughout the growing season. The tunnels rarely extend more than six or eight inches down the stem. In September the larva cleans a place about three-quarters of an inch long near the lower end of the tunnel, cuts through the wood to the epidermis and spins a silken cocoon in the cleared portion, where it remains throughout the winter. The mature larva measures about 12 mm. in length and is very similar to the larva of *Janus abbreviatus* (Say), according to Middleton.[77]

Pupation takes place early in the spring and this stage lasts about two weeks before the adults emerge. There is but one generation a year.

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[76] Cornell Univ. Exper. Sta. Bull., 126, pp. 41–53, (1897).

[77] Proc. Ent. Soc. Wash., XIX, p. 176, (1917).

## **HARTIGIA** Schiödte

1838. *Hartigia* Schiödte, Kroyer's Naturhist. Tidsk., II, p. 332. (No species named.)

1855. *Hartigia* (Boie), Ent. Zeit., XVI, p. 49. (Genotype: *Astatus satyrus* Panzer. Monobasic.)

1860. *Cerobactrus* O. Costa, Fauna Napoli, Cephid., p. 9. (Genotype: *Cerobactrus major* O. Costa. Monobasic.)

1878. *Macrocephus* Schlectendal, Ent. Nachr., IV, p. 153. (Genotype: *Macrocephus ulmariae* Schlectendal. Monobasic.)

1881. *Cephosoma* Gradl, Ent. Nachr., VII, p. 294. (Genotype: *Cephosoma syringae* Gradl. Monobasic.)

1882. *Copiosoma* Kirby, List Hym. Brit. Mus., I, p. 364. [Misspelling for *Cephosoma* Gradl.]

1899. *Adirus* Konow, Ent. Nachr., XXV, p. 74. (Genotype: *Cephus trimaculatus* Say. Monobasic.)

1900. *Aridus* Smith, Ins. of N. J., p. 600. [Misspelling for *Adirus*.]

1931. *Paradirus* Dovnar-Zapolskij, Ann. Mus. Zool. Acad. Leningrad, XXXII, p. 39. (Genotype: *Paradirus algiricus* Dovnar-Zapolskij. Monobasic.)

GENOTYPE: *Syrex niger* Harris, 1776, = *Hartigia nigra* (Harris).[79] (By subsequent designation of Boie, 1855.[78])

In 1838 Schiödte proposed the generic name *Hartigia* for a certain cephid which differed from *Cephus pygmaeus* (Linnaeus) in characters of the antennae, but he did not include a named species. Schiödte's genus remained a *nomen nudum* until 1855 when Boie stated that *Astatus satyrus* Illiger was in all probability the species Schiödte had, and therefore this species becomes the genotype of *Hartigia* by subsequent designation of Boie. Boie credits *satyrus* to Illiger, but I have been unable to locate such a species in any of Illiger's works. Boie undoubtedly was referring to Panzer's species described in 1804.[80]

*Cerobactrus* proposed by O. Costa in 1860 contained only one species, *C. major*, and *Cephosoma* of Gradl (1881) also contained but a single species, *C. syringae*, and are both, therefore, monobasic. *C. major* Costa and *C. syringae* Gradl are both specifically identical with *satyrus* Panzer and consequently these two genera fall to the older name *Hartigia*.

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[78] Ent. Zeit., XVI, p. 49, (1855).

[79] Because of the many synonyms of this species it seems that a complete synonymy of the genotype should be given here. The complete synonymy as understood by Mr. R. B. Benson and myself is as follows: *Syrex niger* Harris, 1776 = *Astatus satyrus* Panzer, 1804 = *Cerobactrus major* O. Costa, 1860 = *Cephus brachyterus*. *Cephus helleri* Taschberg, 1871 = *Phylloecus rubi* Perris, 1875 = *Cephus albomaculata* Tischbein, 1876 = *Cephus giraudi* Schlectendal, 1879 = *Cephus fumipennis* Ed Andre, 1879 = *Cephosoma syringae* Gradl, 1881 = *Cephus cruciatus* A. Costa, 1894 = *Hartigia nigra* (Harris) Enslin, 1917.

[80] Faun. Ins. Germ., heft 85, pl. 12, (1804).

In 1878 Schlectendal proposed the name *Macrocephus* in which he included but a single species, *Macrocephus ulmariae* Schlectendal (= *Tenthredo linearis* Schrank) which is congeneric with *Astatus satyrus* Panzer (= *Syrex niger* Harris = *Hartigia nigra* (Harris) ). *Macrocephus* is therefore monobasic and also an absolute synonym of *Hartigia*.

Kirby in 1882 lists the genus *Copiosoma*, but he credits it to Gradl with the correct citation, so this is obviously a typographical error.

Rohwer[81] in 1911 gives *Astatus satyrus* Rossi as the genotype of *Hartigia*. Rohwer's crediting of this species to Rossi is undoubtedly an error as in his manuscript cards in the genotype file of the United States National Museum he credits this species to Illiger, which, as has already been mentioned, is evidently also an error. However, later in the same publication[81] Rohwer correctly credits Panzer with the authorship of *satyrus*.

Benson[82] is the first author to place *Adirus* Konow as a synonym of *Hartigia*. The same author[82] also places *Paradirus* Dovnar-Zapolskij as a synonym of this genus. I feel that Mr. Benson is correct in his synonymizing of *Adirus* with *Hartigia* and I am following his synonymy. I have not been able to examine any specimens of Dovnar-Zapolskij's genus so I am following Mr. Benson's work.

The members of this genus may be separated from the other nearctic genera of Cephidae by the antennac being swollen beyond the fifth segment (Fig. 58), by the bidentate mandible with the swollen inner tooth (Fig. 26), by the clypeal margin with a large, rounded, asymetric lobe (Fig. 48), and by the shape of the tarsal claws.

There are three described species of this genus in the nearctic fauna, two of which, *Hartigia cressonii* (Kirby) and *Hartigia trimaculata* (Say), are important economic pests.

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[81] U.S.D.A., Bur. Ent., Tech. Ser., Bull. 20, pt. 2, pp. 80 and 97, (1911).

[82] Ann. and Mag. Nat. Hist., (10), xvi, p. 544, (1935).

*Characteristics.*—Head transversely quadrate, not concave behind; front raised between antennae; antennae 23- to 25-segmented, the three basal segments of flagellum longer than wide (Fig. 58); face flattened; left mandible bidentate with inner tooth swollen at tip (Fig. 26); clypeal margin smooth with central lobe asymmetric, rounded or only slightly angulate at ends (Fig. 48); tarsal claws bifid, curved, with inner tooth stouter than outer one, claw slightly swollen near base (Fig. 63); hind tibiae with one pre-apical spur. Female: annuli present on lance, lancet with distinct alar spurs; teeth of lance and lancet angular (Fig. 29). Male: penis valves short, truncate, not much longer than volsella and sagitta (Fig. 11); median sclerotized style not well developed (Fig. 11).

## *Key to nearctic species of Hartigia*

1. Abdomen with apical sternite divided by sheath (Fig. 21) Females....2
   Abdomen without apical sternite divided (Fig. 10) Males.............4
2. Antennae with segments 5 to 16 orange; abdomen with entire second, third, fifth, and eighth tergites yellow.....................*cressonii*
   Antennae black; abdominal tergites not colored as above............3
3. Abdomen with second and third tergites orange; tibiae and tarsi orange. *cowichana*
   Abdomen with yellow or whitish spots or bands usually on third and fifth tergites; tibiae and tarsi dusky brown. *trimaculata*
4. Tibiae and tarsi orange; abdomen with third tergite orange; penis valve as in figure 12..........................................*cowichana*
   Tibiae and tarsi brown; abdomen with at most a yellow or white spot or band on third tergite.........................................5
5. Femora black; tibiae and tarsi yellow-brown; penis valve as in figure 13. *cressonii*
   Femora brown; inner side of fore tibiae yellow; remaining tibiae and tarsi brown; penis valve as in figure 14.................*trimaculata*

**Hartigia trimaculata** (Say). New combination

1824. *Cephus trimaculata* Say, Keating's Narrat. Exped. St. Peter's Riv., II, p. 313.

1869. *Phylloecus trimaculatus* Norton, Trans. Amer. Ent. Soc., II, p. 345.

1875. *Phylloecus bicinctus* Provancher, Nat. Can., VII, p. 375. [New synonymy.]

1880. *Cephus bifasciatus* Cresson, Trans. Amer. Ent. Soc. VIII, p. 33. [New synonymy.]

1880. *Cephus fasciatus* Cresson, Trans. Amer. Ent. Soc., VIII, p. 33. [New synonymy.]

1880. *Cephus bicinctus* Norton, Trans. Amer. Ent. Soc. VIII, p. 47.

1898. *Syrista trimaculatus* Konow, Ent. Nachr., XXIV, p. 76.

1898. *Macrocephus fasciatus* Konow, Ent. Nachr., XXIV, p. 77.

1898. *Macrocephus bicinctus* Konow, Ent. Nachr., XXIV, p. 76.

1899. *Adirus trimaculatus* Konow, Ent. Nachr., xxv, p. 74.
1900. *Aridus trimaculatus* Smith, Ins. New Jersey, p. 600. [Misspelling for *Adirus.*]
1915. *Macrocephus nigripennis* Ghigi, Redia, x, p. 306. [New synonymy.]
1937. *Hartigia nigripennis* Klima, Hym. Cat., pt. 2, p. 19.

The female of this species may easily be distinguished from the other members of the genus by its dark color, being dark brown to black with variable whitish yellow markings on the third and fifth tergites. The males are sometimes difficult to distinguish from those of *H. cressonii* but the legs in *trimaculata* are usually entirely dark brown without yellowish or orange tinge. There is a great deal of variation in size, especially in the female sex. The wings vary greatly in both sexes from a clear hyaline to a dark smoky brown.

*Characteristics.*—Black, usually with white spot between compound eyes and (yellow in ♂) posterior ocelli, one on each inner orbit below antennae and usually spots or bands of yellowish white on third and fifth tergites; wings hyaline to dark smoky; head, thorax and abdomen distinctly reticulated and with appressed golden brown pubescence.

♀. Head black, except for white spots on each temple and inner orbits, transversely quadrate; vertex shallowly and confluently roughened; postocellar line equalling ocellocular line; lateral ocellar line less than diameter of posterior ocelli; an oblique depression extending antero-laterally from each posterior ocellus toward the anterior ocellus; ocellar basin shallow, impunctate, shining, broad, extending almost to base of antennae; antennae 23- to 25-segmented, slightly clavate beyond fourth segment, tapering slightly toward apex; clypeus asymmetric and rugose; clypeal margin slightly angulated at ends; mandibles translucent, slightly yellowish, extreme tips black; palpi brown.

Pronotum uniformly roughened with shallow, confluent reticulations; praescutum and scutum closely, finely punctured, with numerous interspersed minute punctulations; scutellum sparsely punctured; mesepisternum with fine, shallow reticulations; mesoventer roughened; spiracles of basal plates on slight prominence and opening caudo-laterally.

Wings hyaline to dark smoky or often stained yellowish, outer margin darker, all veins brown; first marginal cell wider at base along stigma than between radial veins. Legs brownish to black.

Abdomen compressed, elongate, widened dorso-ventrally toward apex; black except for white spots or bands on third and fifth tergites; saw-sheath short, wide at base, reaching only slightly beyond tip of abdomen (Fig. 21); cerci black; saw amber.

Length, 11–15 mm.; length of fore wing, 8–10.5 mm.

♂. Differs from the female in the following particulars: The spots on the head are yellow and vary greatly in their extent; the spots below the antennae on the inner orbits are larger, often occupying the entire space from the antennae to the mandibles; there is usually a small yellow spot below each antenna, and one on each side of the anterior margin of the clypeus; there is usually a small yellow spot on each temple and one on each gena; the light markings on the abdomen vary from a large spot on each side of the third tergite to bands on the sides of the third and fifth tergites; abdomen not compressed or enlarged toward the apex.

Length, 9 to 11.5 mm.; length of fore wing, 6 to 8 mm.

As has already been mentioned, this species varies greatly in the coloration of the wings. Reared specimens have been examined in which the wings varied from a clear hyaline to a deeply infuscated or obscure blackish. It is usually the larger specimens that have the darker wings. Norton [83] mentioned that there was much variation in the color of the wings of this species. The color markings on the abdomen are also variable. Several specimens were examined which had the head immaculate. This condition was noted by Say in his original description.

*Type.*—The type of this species has been lost. The above description was drawn from specimens collected in Pennsylvania, the type locality.

A specimen from Pennsylvania in collection of the Academy of Natural Sciences of Philadelphia which closely agrees with Say's description has been designated as a neotype.

This species is placed in the genus *Hartigia* for the first time here although Benson [84] placed the genus *Adirus* in synonymy with Hartigia in his recent publication.

*Phylloecus bicinctus* Provancher is also placed here as a synonym of *Hartigia trimaculata* (Say) for the first time. I have not seen the type of Provancher's species but Mr. Georges Gauthier of the Provincial Museum, Quebec, has very kindly examined it and compared it with specimens sent to him. Mr. Gauthier informs me that the type specimen was not labeled as being collected at Cap Rouge, Quebec, which information is included in the original description. The type, according to Rohwer [85] is a female and bears the yellow label no. 180 and is in the 1st Collection, Public Museum, Quebec. The markings on the abdomen are white instead of yellow as in Say's description of *trimaculata.* However, there seems to be no doubt but that this species of Provancher's should fall under the older name of *trimaculata.* Reared material that has been examined shows the same wide color range as do the published descriptions of *trimaculata* and *bicinctus.*

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[83] Trans. Amer. Ent. Soc., II, p. 345, (1869).

[84] Ann. and Mag. Nat. Hist., (10), XVI, p. 544, (1935).

[85] Can. Ent., L, p. 166, (1918).

The type of *Cephus bifasciatus* Cresson, a female, is in the Academy of Natural Sciences of Philadelphia, no. 532. I have examined it and find that it checks very closely with specimens of *trimaculata.* The markings are yellowish white and there are bands on the apical margins of the third and fifth tergites.

The types of *Cephus fasciatus* Cresson is a female in the Academy of Natural Sciences of Philadelphia, no. 533. I have examined it and find it is in good condition except that both antennae are missing. In morphological characters it is identical with *trimaculata,* but is a brightly colored specimen with yellow bands on the second, third, fifth and sixth tergites. The basal half of the middle and hind tibiae are white, and the remaining portions of the legs brownish yellow.

*Macrocephus nigripennis* Ghigi is also placed here as a synonym of *trimaculata* for the first time. I have not been able to examine the types of this species but basing my conclusions on the original description, there is no doubt but that it is identical with Say's species. Ghigi's description is based upon two females and a male from Philadelphia, Pennsylvania and are deposited in the Museo Zoologico Berlino.

*Specimens examined:* Total 76; 47♀, 29♂.

CONNECTICUT: 1♂, Hamden, July 15, 1918, (M. P. Zappe); 1♂, Orange, June 2, 1920, (W. E. Britton), [Conn.]. 1♀, Lyme, June 30, 1918, (W. S. Fisher), [U.S.N.M.].

COLORADO: 1♀, "Col.", [A.N.S.P., type of *C. fasciatus* Cresson]. 1♀, "Col.", [A.N.S.P., type of *C. bifasciatus* Cresson]. 1♀, Golden, June 26, 1898, [C.U.]. 1♂, El Paso County, June 7, 1914, [U.S.N M.]. 1♀, Boulder, May 25, 1933, (M. T. Jones), [Ill.].

DISTRICT OF COLUMBIA: 2♀, 2♂, June 1889, 1912, 1920, (D. H. Blake in part), [U.S.N.M.].

FLORIDA: 1♂, Enterprise, May 7, (Ashmead), [U.S.N.M.]. 1♂, Capron, April 1919, [A.N.S.P.].

GEORGIA: 1♀, St. Thomas, May 5, 1930, (P. W. Fattig), [U.S.N.M.].

ILLINOIS: 1♀, Odin, May 28, 1910, [Ill.].

LOUISIANA: 1♂, Opelquasas Pilate; 1♂, "La."; [U.S.N.M.].

MARYLAND: 1♀, "Md.", [U.S.N.M.].

MASSACHUSETTS: 1♀, Boston, July 6, 1921, (H. Morrison), [U.S.N.M.].

MICHIGAN: 1♀, Monroe, July 2, 1928, [U.S.N.M.].

MISSISSIPPI: 1♀, (Ashmead), [U.S.N.M.].

MISSOURI: 1♀, May 18, 1872, (C. V. Riley), [U.S.N.M.].

MONTANA: 1♀, "Mont.", [A.N.S.P.].

NEW HAMPSHIRE: 1♂, "N.H.", [A.N.S.P.].

NEW JERSEY: 1♀, Riverton, July 25, 1927, (C. H. Ballou); 1♂, "New Jersey", June 18, 1890, [U.S.N.M.]. 1♀, Trenton, July 7, 1911, (Harbeck), [Penn.].

NEW YORK: 1♂, 1♀, Ithaca, June 6–15, 1907, 1925, (P. P. Babiy in part), [B.M.N.H., C.U.]. 1♀, Taughannock Falls, July 4, 1914; 1♀, Slaterville; [C.U.]. 1♂, Yaphank, Long Island, June 15, 1912, (C. P. Englehardt), [D.T.R.]. 1♀, Rockaway, [A.M.N.H.]. 1♂, Albany, July 3, 1906, [N.Y.S.].

NORTH CAROLINA: 1♀, Tryon, [U.S.N.M.].

OHIO: 1♂, 1♀, Put-in-Bay Island, June 20–30, 1929, (C. H. Kennedy), [O.S.U.].

OKLAHOMA: 1♀, Ardmore, June 1, 1909, (F. C. Bischop), [U.S.N.M.].

PENNSYLVANIA: 3♀, Harrisburg, June 19–July 4, 1915, 1917, (W. S. Fisher, J. G. Sanders), [U.S.N.M., Penn.]. 2♀, Inglewood, May 21–June 1, 1920, (J. N. Knull, A. B. Champlain), [Penn.]. 1♂, Pittsburgh, June 28, 1908, (Homer C. Will), [H.C.W.]. 5♀, "Penn.", (C. V. Riley in part), [A.M.N.H., A.N.S.P., neotype, D.T.R.]. 1♀, Hartstown, June 1914, (J. N. Knull); 1♀, Enola, June 12, 1909, (P. R. Myers); 1♀, Highspire, July 2, 1909, (W. S. Fisher); 1♂, North East June 18, 1916, (R. A. Cushman); 1♀, Castle Rock, June 19, 1910; [all U.S.N.M.]. 1♀, Philadelphia, [A.N.S.P.].

SOUTH CAROLINA: 2♂, "S.Car.", May 31–June 16, 1895, 1896, [U.S.N.M.]. 1♂, Greenville, May 27, 1930, (H. K. Townes, jr.), [H.K.T.].

WASHINGTON: 1♂, Pullman, [Ill.]. 1♀, Wawawai, July 8, 1920, (R. C. Shannon), [U.S.N.M.].

CANADA: 1♀, 1♂, Awema, Manitoba, June 4 – July 18, 1911, 1924, (N. Criddle, R. D. Bird) [Ill., C.N.C.]. 1♀, Vasceaux Lake, British Columbia, June 14, 1919, (E. R. Buckell), [Dom.]. 1♂, Montreal, Quebec, [D.T.R.]. 1♂, Hastings, Ontario, 1895, (Evans), [C.N.C.]. 1♀, Pelee Island, Ontario, July 1–10, 1929, (C. H. Kennedy), [O.S.U.]. 1♂, Smoky Falls, Mattaganic Riv., Ontario, July 11, 1934, (G. S. Walley); 1♂, Ag. Coll., Manitoba, July 5, 1923, (Eric Kitely); [C.N.C.].

*Locality unknown:* 3♀, 3♂, [C.U., Ill., A.N.S.P.].

*Life History.*—Not a great deal is known of the biology of *Hartigia trimaculata* (Say). MacGillivray [86] reports this species as boring in the canes of blackberry, while Middleton [87] gives the host as rose. Britton [88] mentions that larvae were collected from rose and reared in Connecticut. These reared adults have been examined and found to be this species. The most complete life history study thus far published is that of Champlain.[89] A résumé of Champlain's work is given in the following paragraphs:

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[86] State Geol. & Nat. Hist. Surv., Bull. 22, p. 173, (1916).

The adults of this species fly during the latter part of May and through June and July in Pennsylvania. Oviposition was observed by Champlain on July 12, 1924. The females were observed flying around the rose bushes, alighting from time to time on the terminals of the new shoots grown that season. Moving down the terminals head first the female used the tip of the abdomen and sometimes the ovipositor as a tactile organ, inserting the latter at short intervals into the tissue of the new growth. The egg was placed in the pith at right angles to the outer bark. Considerable damage was done by the females in puncturing the buds and terminals, but the author reports that it is unlikely that all the punctures contained eggs.

The first larva to hatch is the one that survives in a single terminal, as never more than a single larva was observed in each tunnel. The larva begins feeding on the terminal, which wilts and dies, and then starts feeding on the pith, packing the excrement in the tunnel behind it as it moves down the stem. The length of the tunnel varies with the length of the shoot and also according to when the egg was laid in relation to the season.

At certain intervals the larva girdles the inside of the stem above the spot where it is feeding, frequently causing the stem to break over at that point. When full grown it makes a partial opening in the stem to the outside; then spins a cocoon and overwinters in the portion of the tunnel where it was last feeding.

The mature larva, according to Middleton,[87] is pinkish white, cylindrical, with the thorax slightly enlarged, and measures about 21 mm. in length. The dorso-ventral length of the head is 2 mm. and the breadth 1.66 mm. The head is pale with the mandibles, their articulations, and the labrum chitinized and darkened. The

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[87] Proc. Ent. Soc. Wash., XIX, p. 175, (1917).

[88] Rept. State Entomologist Conn., p. 372, (1922).

[89] Jour. Econ. Ent., XVII, p. 648, (1924).

antennae are 4-segmented. The thorax has three pairs of small mamma-like, unchitinized, fleshy legs, faint yellowish chitinized spots on the pleura, and the prothorax distinctly chitinized dorsally. The abdomen has three annulate segments, the pleura prominent with a slight, very faintly chitinized, longitudinally creased swelling; prolegs are absent; the dorsal anal lobe terminates in a prong; the anal plate, ventral anal lobe, and lateral area of dorsal anal lobe are haired (Fig. 70); lateral area of dorsal anal lobe yellowish with chitin, the ventral anal lobe with palpiform appendages and with several spines detached from the mass of that lobe's ornamentation.

Pupation takes place in the spring and the first adults emerge the latter part of May in Pennsylvania.

**Hartigia cressonii** (Kirby)

1880. *Cephus abdominalis* Cresson (nec Latreille, 1816), Trans. Amer. Ent. Soc., VIII, p. 33. (♀.)
1882. *Cephus cressonii* Kirby, List Hym. Brit. Mus., I, Add., p. 403.
1898. *Astatus abdominalis* Konow, Ent. Nachr., XXIV, p. 77.
1912. *Hartigia abdominalis* Essig, Mo. Bull. Calif. Comm. Hort., I, pp. 889–901. (♂, ♀.)
1913. *Hartigia cressoni* Essig, Mo. Bull. Calif. Comm. Hort., II, p. 279.
1937. *Eumetabolus cressoni* Klima, Hym. Cat., pt. 2, p. 27.

The female of this species is easily distinguished from the other members of the genus by the extensive amount of yellow on the abdomen and the bright yellow median portion of the antennae. The male is often difficult to distinguish from those of *trimaculata,* but may be by the yellow apical tergite and the markings on the second, third, fifth, and seventh tergites which are yellow.

The name *abdominalis* given this insect by Cresson in 1880 was changed in 1882 to *cressonii* by Kirby, who found Cresson's original name was preoccupied by Latreille in 1816.

*Characteristics.*—Black or brownish black and yellow; middle of antennae, apical portions of legs, the 1st, 2nd, 3rd, 5th, apex of 6th, and last tergite yellow in ♀; ♂ brownish black with much less yellow; wings stained yellow; head, thorax, and abdomen sparsely covered with golden pubescence.

♀. Head transversely quadrate; vertex with evenly scattered setiferous punctures; postocellar line slightly less than ocellocular line; lateral ocellar line less than the diameter of posterior ocelli; posterior ocelli with oblique shining, impunctate depression extending from close behind each ocellus in a latero-cephalad direction; ocellar basin shallow, small impunctate; front slightly raised between antennae; antennae 25-segmented, distinctly clavate beyond fifth segment, tapering slightly again toward apex; segments five to sixteen orange yellow; face almost impunctate, shining and flattened; head blackish with spot on each temple, one in center of caudal margin of occiput, spots on each gena, lower inner orbit, malar space, face, clypeus, and base of mandibles yellow; tips of mandibles rufous, palpi brownish white.

Pronotum evenly covered with fine, shallow, setiferous punctures, posterior margin yellow and slightly concave, yellow interrupted medially; praescutum and scutum rather closely, evenly, but not confluently punctured; scutellum more sparsely and shallowly punctured, shining, with large distal yellow patch; mesepisternum shallowly, minutely reticulate, sparsely covered with stout, light pubescence, upper cephalic angle yellow.

Wings stained yellowish; costa, stigma, and veins brownish yellow. Coxae, trochanters, and femora, except small basal portion of last, yellow, almost black; base and outer portion of ultimate tarsal joint and claw dark brown.

Abdomen compressed, somewhat widened toward apex; apical half of first, entire second, third, and fifth, apical half of sixth and seventh and entire eighth tergite, a narrow apical band on margins of first, second, third, and fifth sternites, yellow; remainder of abdomen brown; cerci light brown; sheath black, short, extending only slightly beyond tip of abdomen, upper margin slightly convex, lower margin slightly concave; saw yellowish brown.

Length, 16 mm.; length of fore wing, 10.5 mm.

♂. Differs from female in the following particulars: Antennae light brown; base of mandibles, malar spaces, lower inner orbits, a small spot on each temple, a small spot on sides along apical margins of second, third, fifth, a narrow line on apical margin of seventh, and entire eighth tergite yellow; all legs brown to yellowish brown.

Length, 13 mm.; length of fore wing, 8 mm.

*Type.*—The type of *Cephus abdominalis* Cresson is a female from Nevada in the collection of the Academy of Natural Sciences of Philadelphia, no. 531. I have examined this specimen and a paratype in the same institution and found both are in good condition.

*Specimens examined:* Total 35; 26♀, 9♂.

CALIFORNIA: 4♂, 2♀, Placer County, (E. O. Essig); 1♀, Pasadena, May 25, 1919, (F. Grinnell, jr.); [C.U., U.S.N.M., D.T.R.]. 9♀, Chico, Mar. 13–Apr. 26, 1908, (A. Yuhnke, W. B. Parker), [U.S.N.M., D.T.R.]. 2♂, 1♀, Sacramento, June 4, 1915, Apr. 1931, (H. H. Kiefer, M. C. VanDuzee), [Calif., I.U.]. 3♀, 1♂, Oroville, Feb. 4–11, 1926, (H. H. Kiefer); 1♀, Davis Creek, July 14, 1922, (C. L. Fox); 1♀, Mill Valley, Feb. 1, 1926, (E. P. VanDuzee); 1♂, Martinez, Apr. 17, 1911, (J. G. Grundell); [all C.A.S.]. 2♀, Bowman, Feb. 1912, (E. O. Essig); 1♀, Alhambra, June 1920, (W. M. Davidson); 1♀, Los Angeles County, June; 1♀, Sonora County; [all U.S.N.M.]. 1♀, Portola, June 5, 1915, [I.U.].

NEVADA: 2♀, "Nev.", [A.N.S.P., type and paratype of *abdominalis*].

*Life History.*—The first biological work was done on this species by Dr. E. O. Essig[90] in California in 1911, where the insect was doing considerable damage to the young growing canes of raspberry in the central and northern foothill counties. The same author[91] reports that this species infests both wild and cultivated blackberries, loganberries, raspberries, and roses, and that there are possibly two broods a year.

The glossy, pearly white, oval, flattened eggs are about 1.5 mm. long and about two-thirds as wide at their greatest breadth. The female places the eggs in a slit just beneath the epidermis of the young canes usually near the second or third leaf axil. Egg-laying occurs from the beginning until about the middle of May. No data is given on the incubation period. The oviposition puncture is readily found because of a discoloration which soon appears.

Soon after hatching the young larvae begin feeding on the surrounding tissues and remain near the point of hatching until they are about 6 mm. long. They then begin their travel downward, burrowing in spirals in the cambium layer for about an inch; then work into the pith and begin an upward course to the tip of the young shoot which soon withers and dies. As soon as the branch dies the larvae start downward, working through the center of the pith. This downward course continues to within several feet of the ground or even into the roots. The larval stage lasts until October, the average active period being from four to six months.

The mature larva measures about 22 mm. in length, is whitish in color, cylindrical, and somewhat enlarged dorsally and laterally in the thorax. The head is pale, measuring 1.87 mm. in length

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[90] Mo. Bull. Calif. Comm. Hort., I, pp. 889–901, (1912).

[91] Injur. Insects West N. Amer., pp. 775–776, (1926).

and 1.66 mm. in breadth; the mandibles, their articulations, and the labrum are chitinized and darkened; antennae 5-segmented; thorax with three pairs of medium-sized, fleshy mamma-like and lightly chitinized legs; the pleura, pro-, and metathorax have dorsal chitin spots; abdomen with three annulate segments, with pleura moderately prominent, yellowish and glossy with chitin, slightly chitinized circles on the eighth and larger and more heavily chitinized circles on the ninth segment; prolegs absent; dorsal anal lobe terminates in a prong (Fig. 71); anal plate, lateral area of dorsal anal lobe and ventral lobe haired, chitinized, and yellow; ventral anal lobe with palpiform appendages at the posterior lateral extremities.

**Hartigia cowichana** Ries

1937. *Hartigia cowichana* Ries, Ent News, XLVIII, p. 82. (♀.)

This species differs from the other known species of the genus not only in color and appearance but also in the shape of the penis valves in the male and the shape of the teeth of the lancet in the female.

Both sexes of this species very closely resemble *Caenocephus aldrichi* Bradley in both size and color, but morphological characters such as the presence of two transverse cubital veins in the hinds and a single pre-apical spur on each posterior tibia; shape of the left mandible, posterior tarsal claw, and structure of the antennae as well as the shape of the clypeal margin definitely place it in the genus *Hartigia.*

*Characteristics.*—Black, except at base of abdomen, tibiae and tarsi which are red; wings smoky hyaline.

♀. Head transversely quadrate, very slightly concave behind; vertex closely and evenly covered with setiferous punctures; ocellocular line greater than postocellar line; a distinct oblique impunctate area laterad of the posterior ocelli; ocellar basin shallow and broad; lateral ocellar line about equal to diameter of posterior ocelli; front bluntly raised between antennae; front below antennae evenly punctured and covered with fine bronze pubescence; antennae 25-segmented, distinctly clavate beyond third segment, tapering slightly at apex, base black, lighter brown from sixth segment to apex; head black, except for small irregular spot on temples and a small spot in the clypeocular space yellow; mandibles black with yellow near base, tips mahogany colored; palpi brown.

Pronotum densely punctured and covered with bronze pubescence; anterior margin concave and slightly upturned; posterior margin indented medially; praescutum and scutum evenly and closely punctured; scutellum shining and sparsely punctured; mesepisternum closely and evenly punctured; membrances of thorax yellowish white.

Wings yellowish-smoky hyaline with base of costa yellow, stigma and remainder of veins brown. All coxae, trochanters, femora (except small apical portion which is amber), and basal portion of apical tarsal joint and claws brown; tibiae and remainder of tarsi deep amber.

Abodmen compressed, brownish black except second and third tergites orange, a small orange spot on the fourth tergite just in front of the spiracle, lateral margins of second and third tergites with a narrow white line, lateral portions of third sternite washed with brownish orange, lower lateral margin of sixth tergite and caudal margin of sixth sternite washed with indistinct orange, hind margins of seventh and eighth tergites edged with yellowish white, and a small yellowish white spot at base of sawsheath; sheath brownish black, short, blunt and slightly curved downward; saw amber.

Length, 15.0 mm.; length of fore wing, 9.0 mm.

*Type.*—Female; Victoria, British Columbia, May 9, 1922, (W. R. Carter), [C.N.C., holotype, no. 4091].

*Paratype.*— ♀; Vancouver, British Columbia, June 6, 1930, (H. Leech), [A.N.S.P.].

This species has heretofore been known only from the female. Since the publication of the description of the female I have received additional material from Dr. G. Stuart Walley, Department of Agriculture, Ottawa, Canada. This material was collected in the same locality as were the specimens of the female and are without doubt the males of this species. The description of the allotype follows:

♂. Black, except third and fourth abdominal tergites orange, and the apical margin of eighth and tenth tergites yellow; legs orange except coxae, trochanters and femora which are brown.

Head black, except small orange spot on each temple, one one each lower inner orbit and one on each lower gena; vertex confluently covered with shallow setiferous punctures; postocellar line equal to ocellocular line; lateral ocellar line slightly greater than diameter of posterior ocelli; an oblique impunctate depression extending antero-laterad from each posterior ocellus; ocellar basin shallow, shining and broad; front slightly raised between antennae; front below antennae evenly punctured with fine setiferous punctures; antennae 25-segmented; mandibles rufous except for orange spot near base; palpi brown.

Pronotum densely and confluently punctured and covered with bronzy pubescence; anterior margin concave and slightly upturned; posterior margin indented medially; prescutum and scutum evenly and closely punctured; scutellum sparsely punctured anteriorly, apical portion smooth and shining; mesepisternum closely and evenly punctured and covered with thick mat of bronzy pubescence.

Wings yellowish hyaline with base of costa orange brown, remainder of veins and stigma brown. All coxae, trochanters, femora and apical segment and claws of middle tarsi brown, remainder of legs orange.

Abdomen brownish-black except latero-apical portion of third, and all but medial basal portion of fourth tergite orange; apical margin of eighth, and tenth tergites yellow.

Length, 12.0 mm.; length of fore wing, 7.0 mm.

*Allotype.*—Male; Victoria, British Columbia, June 24, 1921, (W. Downes), [C.N.C.].

*Specimens examined:* Total 4; 2♂, 2♀.

CANADA: 1♀, Victoria, British Columbia, May 9, 1922, (W. R. Carter), [C.N.C., holotype]. 1♀, Vancouver, British Columbia, June 6, 1930, (H. Leech), [A.N.S.P., paratype]. 1♂, Victoria, British Columbia, June 24, 1921, (W. Downes), [C.N.C., allotype]. 1♂, Victoria, British Columbia, July 13, 1900, (Rev. G. W. Taylor), [Ill.].

## *Unrecognizable Species*

### **Cephus mexicanus** Guerin

1845. *Cephus mexicanus* Guerin, Iconogr. Regn. Animal. Ins., III, p. 403. (♀.)
1882. *Janus* (?) *mexicanus* Kirby, List Hym. Brit. Mus., I, p. 354.
1898. *Macrocephus mexicanus* Konow., Ent. Nachr., 1898, p. 76.
1937. *Hartigia mexicanus* Klima, Hym. Cat., p. 17.

This species is unknown to me as well as to all the more recent writers. The exact whereabouts of the type is unknown. Guerin placed the species in the genus *Cephus* and mentions that it is not only the first Cephid known from America but that it also closely resembles *C. satyrus* [= *Astatus satyrus* Panzer = *Hartigia nigra* (Harris) ]. Norton[92] gives a translation of Guerin's original description and allows the species to remain in the genus *Cephus*. Kirby[93] questionably places it in *Janus* where it remained until Konow,[94] placed it in *Macrocephus,* which is a synonym of

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[92] Trans. Amer. Ent. Soc., II, p. 344, (1869).

[93] List Hym. Brit. Mus., I, p. 354, (1882).

[94] Ent. Nachr., XXIV, p. 76, (1898).

*Hartigia.* In view of these facts I am calling this species unrecognizable, although in as much as Guerin says that "this species is of the size of *C. satyrus* and closely resembles it", there is a possibility that it does belong to the genus *Hartigia.* Also it is very likely to be a synonym of *Hartigia trimaculata* since that species closely resembles *Hartigia nigra* (Harris) in many respects.

This is the only specimen of a Cephid, as far as can be ascertained, that has been collected in Mexico, but there is nothing in the original description to give any clue as to what part of Mexico Guerin's specimen came.

Here follows the original description by Guerin:

> "*Cephus Mexicanus.* Noir. Mandibules ayant une large tache jaune au milieu de leur longueur; deux très-petites taches jaunes au milieu du front, sous les antennes, plusieurs taches de la même couleur sous le bord inférieur des yeux, près de leur bord supérieur et sur les côtés de la tête, en arrière des yeux. Il y a deux taches jaunes sur l'écusson, le côté extérieur des hanches postérieures est jaune, et les jambes et les tarses sont d'un brun jaunâtre. Ailes transparentes, légèrement enfumées vers leurs extrémité, et a nervures brunes. Abdomen noir avec les second, troisième et cinquième segments largement bordés de jaune en dessus; cette bande dentelée antérieurement et interromque au milieu (femelle).—Long. 15, 1. envir. 22 mill.—Hab. le Mexique.
>
> "Cette espèce est de la taille du *C. satyrus*, et lui ressemble beaucoup. C'est le premier Céphus américain connu jusqu'á présent."

## EXPLANATION OF PLATES

### PLATE XVIII

(Of Male Sex)

Fig. 1.—*Cephus pygmaeus.* Genitalia. Ventral aspect.
Fig. 2.—*Cephus cinctus.* Penis valves. Ventral aspect.
Fig. 3.—*Cephus tabidus.* Penis valves. Ventral aspect.
Fig. 4.—*Cephus pygmaeus.* Tip of abdomen. Ventral aspect.
Fig. 5.—*Cephus cinctus.* Tip of abdomen. Ventral aspect.
Fig. 6.—*Cephus clavatus.* Genitalia. Ventral aspect.
Fig. 7.—*Cephus clavatus.* Penis valves. Ventral aspect.
Fig. 8.—*Cephus clavatus.* Penis valves. Ventral aspect (much enlarged).
Fig. 9.—*Cephus clavatus.* Tip of abdomen. Ventral aspect.
Fig. 10.—*Cephus tabidus.* Tip of abdomen. Ventral aspect.
Fig. 11.—*Hartigia cressonii.* Genitalia. Ventral aspect.
Fig. 12.—*Hartigia cowichana.* Penis valve. Ventral aspect.
Fig. 13.—*Hartigia cressonii.* Penis valve. Ventral aspect.

Fig. 14.—*Hartigia trimaculata.* Penis valve. Ventral aspect.
Fig. 15.—*Caenocephus aldrichi.* Tubercles of penis valve—much enlarged.
Fig. 16.—*Caenocephus aldrichi.* Genitalia. Ventral aspect.
Fig. 17.—*Caenocephus aldrichi.* Penis valve. Ventral aspect.
Fig. 18.—*Janus abbreviatus.* Genitalia. Ventral aspect.
Fig. 19.—*Janus integer.* Penis valve. Ventral aspect.

Abbreviations used

CL = clasper
PV = penis valve
SA = sagitta
VA = volsella

S = median sclerotized style
GS = gonostipes
GO = gonocardo

## PLATE XIX

(Of Female Sex)

Fig. 15.—*Caenocephus aldrichi.* Tubercles of penis valve (much enlarged).
Fig. 20.—*Cephus pygmaeus.* Tip of abdomen. Lateral aspect.
Fig. 21.—*Hartigia cressonii.* Tip of abdomen. Lateral aspect.
Fig. 22.—*Caenocephus aldrichi.* Tip of abdomen. Lateral aspect.
Fig. 23.—*Janus abbreviatus.* Left mandible.
Fig. 24.—*Janus abbreviatus.* Tip of abdomen. Lateral aspect.
Fig. 25.—*Cephus clavatus.* Tip of abdomen. Lateral aspect.
Fig. 26.—*Hartigia cressonii.* Left mandible.
Fig. 27.—*Cephus pygmaeus.* Right mandible.
Fig. 28.—*Caenocephus aldrichi.* Left mandible.
Fig. 29.—*Hartigia cressonii.* Saw.
Fig. 30.—*Hartigia cressonii.* Teeth of lancet (much enlarged).
Fig. 31.—*Hartigia trimaculata.* Teeth of lancet (much enlarged).
Fig. 32.—*Hartigia cressonii.* Alar spines and alar spur (much enlarged).
Fig. 33.—*Cephus clavatus.* Left mandible.
Fig. 34.—*Janus abbreviatus.* Saw.
Fig. 35.—*Janus abbreviatus.* Teeth of lancet (much enlarged).
Fig. 36.—*Cephus tabidus.* Left mandible.
Fig. 37.—*Caenocephus aldrichi.* Saw.
Fig. 38.—*Caenocephus aldrichi.* Teeth of lancet (much enlarged).
Fig. 39.—*Cephus pygmaeus.* Left mandible.
Fig. 40.—*Cephus pygmaeus.* Saw.
Fig. 41.—*Cephus clavatus.* Teeth of lancet (much enlarged).
Fig. 42.—*Cephus tabidus.* Teeth of lancet (much enlarged).
Fig. 43.—*Cephus pygmaeus.* Teeth of lancet (much enlarged).
Fig. 44.—*Cephus cinctus.* Thorax.

Abbreviations used

SH = sheath
CE = cercus
LN = lance
AR = alar spur

T = teeth
AN = annuli
LT = lancet
AS = alar spines

PN = pronotum
PRS = praescutum
ST = scutum
SCL = scutellum

## PLATE XX

### (Of Female Sex)

Fig. 45.—*Cephus tabidus.* Head. Cephalic aspect.
Fig. 46.—*Cephus pygmaeus.* Clypeal margin.
Fig. 47.—*Janus abbreviatus.* Clypeal margin.
Fig. 48.—*Hartigia cressonii.* Clypeal margin.
Fig. 49.—*Caenocephus aldrichi.* Clypeal margin.
Fig. 50.—*Cephus tabidus.* Head. Dorsal aspect.
Fig. 51.—*Cephus pygmaeus.* Fore and hind wings.
Fig. 52.—*Caenocephus aldrichi.* Portion of hind wing.
Fig. 53.—*Janus bimaculatus.* Portion of fore wing.
Fig. 54.—*Janus abbreviatus.* Portion of fore wing.
Fig. 55.—*Janus integer.* Portion of fore wing.
Fig. 56.—*Cephus pygmaeus.* Apical spur on fore tibia.
Fig. 57.—*Cephus pygmaeus.* Antenna.
Fig. 58.—*Hartigia cressonii.* Antenna.
Fig. 59.—*Janus abbreviatus.* Antenna.
Fig. 60.—*Caenocephus aldrichi.* Antenna.
Fig. 61.—*Janus abbreviatus.* Tarsal claw.
Fig. 62.—*Caenocephus aldrichi.* Tarsal claw.
Fig. 63.—*Hartigia cressonii.* Tarsal claw.
Fig. 64.—*Cephus clavatus.* Tarsal claw.
Fig. 65.—*Cephus tabidus.* Tarsal claw.
Fig. 66.—*Cephus pygmaeus.* Tarsal claw.

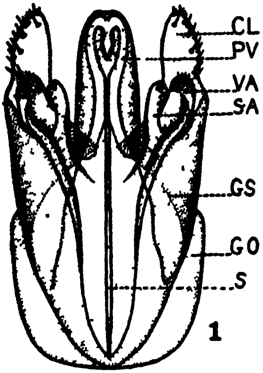
### (Of Larva)

Fig. 67.—*Cephus cinctus.* Tip of abdomen. Lateral aspect.
Fig. 68.—*Cephus pygmaeus.* Tip of abdomen. Lateral aspect.
Fig. 69.—*Cephus tabidus.* Tip of abdomen. Lateral aspect.
Fig. 70.—*Hartigia trimaculata.* Tip of abdomen. Lateral aspect.
Fig. 71.—*Hartigia cressonii.* Tip of abdomen. Lateral aspect.

### Abbreviations used

O = anterior ocellus
OC = ocellar basin
ANT = antenna
FR = front
IN = inner orbit
TF = tentorial fova

CL = clypeus
MS = malar space
MD = mandible
LOL = lateral ocellar line
OOL = ocellocular line
POL = postocellar line



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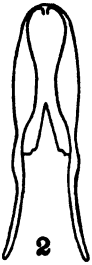
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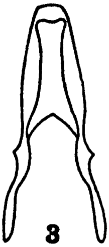
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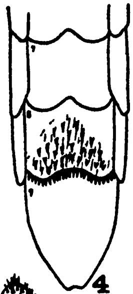
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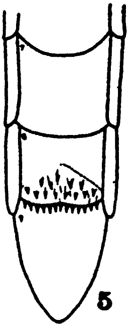
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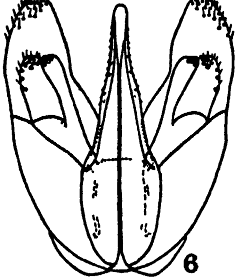
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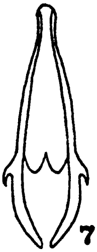
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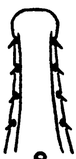
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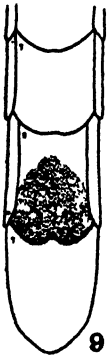
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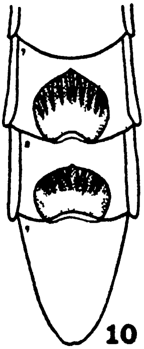
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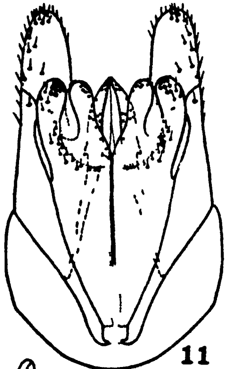
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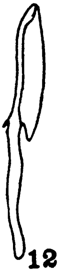
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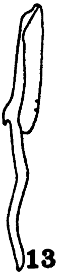
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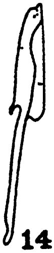
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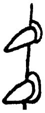
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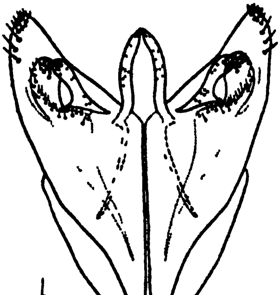
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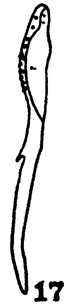
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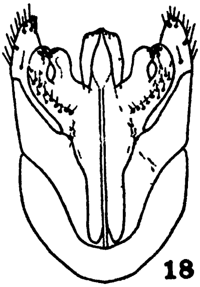
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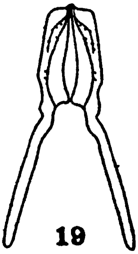
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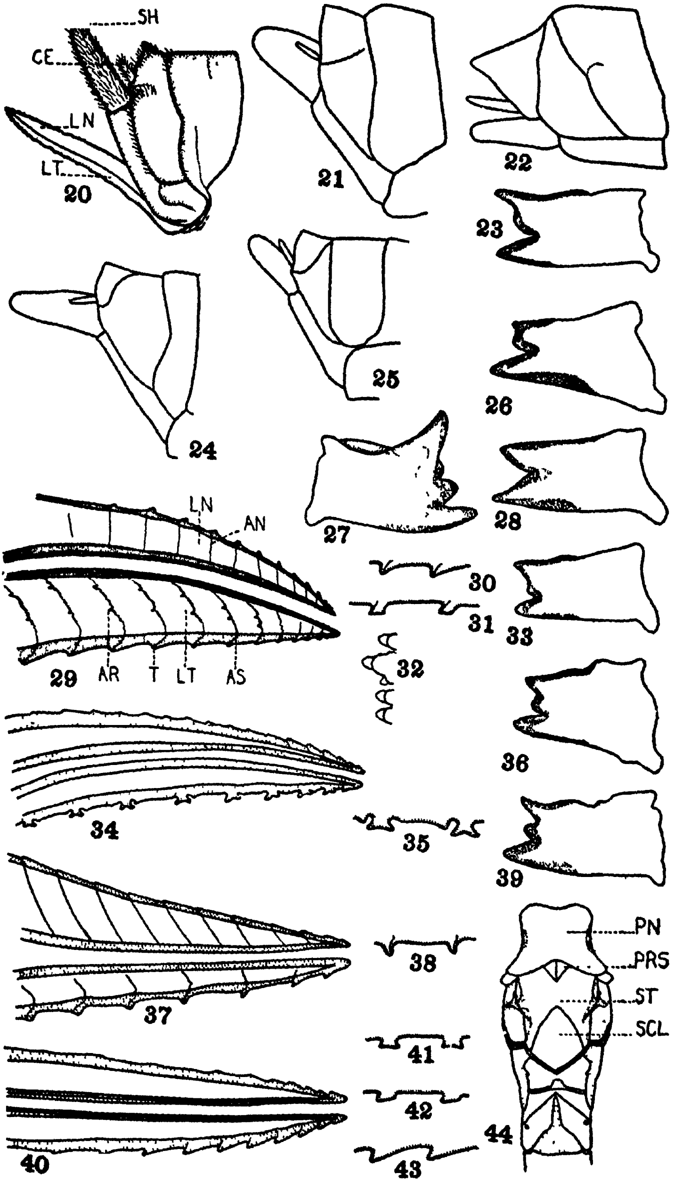
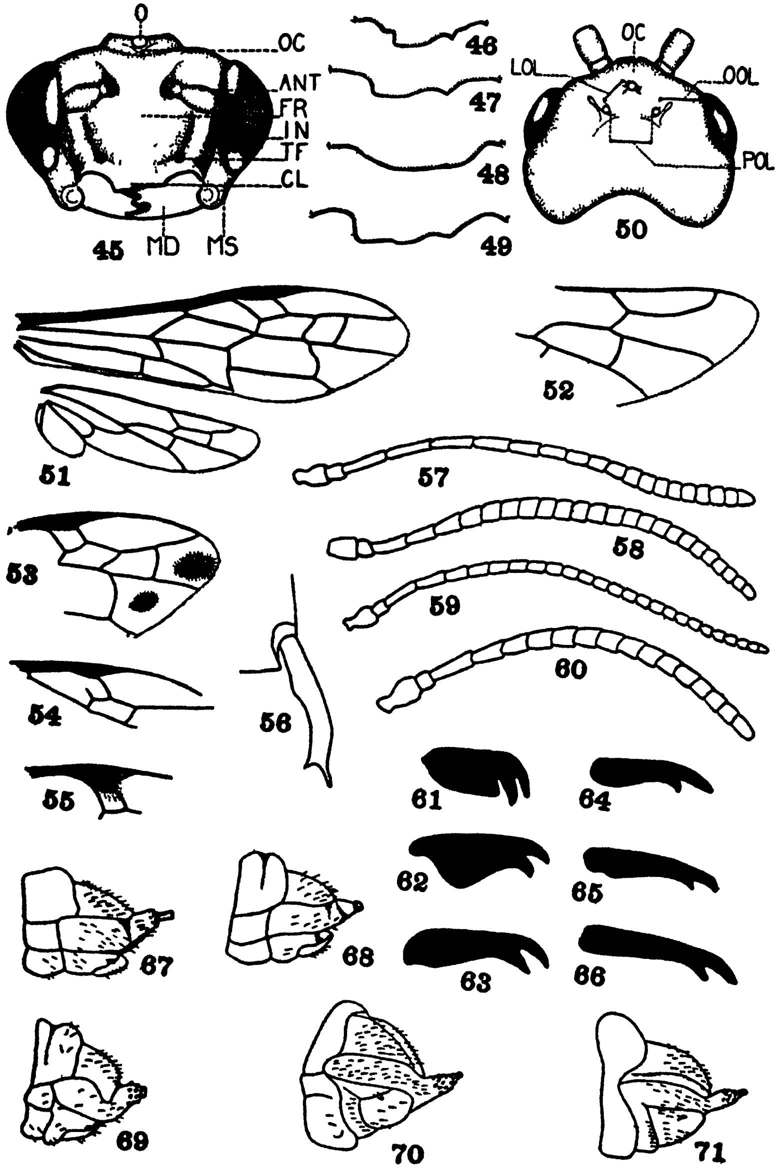
RIES—NEARCTIC CEPHIDAE



RIES—NEARCTIC CEPHIDAE



RIES—NEARCTIC CEPHIDAE

# A NEW SUBSPECIES OF PSOLOESSA DELICATULA

## (ORTHOPTERA: ACRIDIDAE, ACRIDINAE)

BY JAMES A. G. REHN

For a number of years I have had a monographic study of the genus *Psoloessa* in partially completed form, but the intervention of many duties, and other obligations has prevented the completion of the work, although a considerable portion of the necessary illustrations have been completed, as well as certain of the detailed analyses of large series. I fully anticipate the completion and publication of this elaborate study within the next year, but in order that one of the new forms of the genus may be quoted in forthcoming papers by other authors, I am here presenting the description and a brief discussion of this striking new subspecies. Illustrations of the same will be published later in the comprehensive study.

Not wishing to anticipate the detailed study of the structural and color variation to be found in *Psoloessa delicatula* which will appear in the larger paper, I mentioned only those phases which are necessary for a correct understanding of the form here described.

The involved synonymy of the nominate form *Psoloessa delicatula delicatula* will be discussed at length in the forthcoming study, and will not be treated here,[1] other than to say that no previously proposed name is in any way involved with the form here described, except as given below. The new subspecies is that referred to by Hebard,[2] quoting the present author, as "a northwestern geographic race of *delicatula* which will be described."

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[1] In 1925 Hebard (Proc. Acad. Nat. Sci. Phila., LXXVII, p. 65, (1925) established the synonymy of *Stirapleura decussata* Scudder under *Scyllina delicatula* of the same author.

[2] Proc. Acad. Nat. Sci. Phila., LXXX, p. 231, (1928).

The synonymy of the generic name *Stirapleura* Scudder under the prior *Psoloessa* of the same author has already been stated by Hebard[3] quoting the present author. This will be discussed more fully in the forthcoming study.

**Psoloessa delicatula buckelli**[4] new subspecies

1919. *Stirapleura decussata* Buckell (not of Scudder, 1876), Fiftieth Ann. Rep. Entom. Soc. Ontario, p. 55. [Penticton and Fairview, Okanagan Valley, British Columbia.]

1922. *Stirapleura* species Buckell, Proc. Entom. Soc. Brit. Columb., 1922, no. 20, Syst. Ser., p. 19. [Osoyoos, Fairview, Okanagan Falls, Vaseaux Lake, Penticton, Naramata and Keremeos, Lower Okanagan Valley, British Columbia.]

This very distinct geographic race, in its typical condition, can readily be distinguished from *Stirapleura delicatula delicatula* by the more attenuate form, more compressed and proportionately deeper body, more produced and angulate fastigium, more regularly quadrate lateral lobes of the pronotum, the markedly more elongate pronotal disk with less decidedly clepsydral lateral carinae, and the more elongate and slender limbs.

*Type.*— ♂ ; Oliver, Okanagan Lake, Yale District, British Columbia. May 10, 1923. (E. R. Buckell). [Academy of Natural Sciences of Philadelphia, Type no. 5569].

*Description of type.*—The following features are comparative almost entirely, and are given as the result of critical comparisons of the type with average male individuals of *Stirapleura delicatula delicatula* from Trinidad, Colorado.

Form relatively deep, subcompressed, particularly dorsad.

Head with fastigio-facial angle and inter-antennal portion of frontal costa in profile more produced cephalad of eyes than in *d. delicatula*, fastigio-facial angle appreciably more evident and less broadly rounded in the same aspect; lateral facial foveolae more elongate; frontal costa shallowly excavato-sulcate, bringing the lateral margins into low relief; seen in cephalic aspect the head is distinct narrowed dorsad, the eyes being less bullate than in *d. delicatula*: fastigium from dorsum more produced cephalad, markedly acute-angulate both in marginal outline and cephalic outline of excavation. Eyes in profile with dorso-cephalic and ventro-cephalic portion of their margin more angulate in *d. delicatula*. Antennae slightly more elongate.

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[3] Proc. Acad. Nat. Sci. Phila., LXXX, p. 231, (1928).

[4] Names in honor of our colleague Mr. E. R. Buckell, Entomologist of the Department of Agriculture of British Columbia, to whose credit the virtual discovery of this very distinct subspecies should be placed, and whose observations constitute nearly all the data we have on its habits.

Pronotum more elongate than in *S. d. delicatula,* its median constriction or subsellation less evident, greatest width across caudal portion of pronotal disk proportionately less; lateral carinae of disk clepsydral, but distinctly less strongly so than in *d. delicatula,* the divergence of the carinae cephalad and caudad being less decided and more gradual, greatest width caudad between outer (lateral) borders of carinae three-fourths of greatest length of disk (average four-fifths in *d. delicatula*): lateral lobes of pronotum subquadrate, not deeper than long as in *d. delicatula*; caudal margin straighter, ventro-caudal angle narrowly rounded rectangulate, caudal section of ventral margin straight; surface of lateral lobes with the oblique callose ridge found well indicated in *d. delicatula* represented by a much less evident remnant.

Tegmina with apex proportionately narrower than in *d. delicatula.*

Interspace between mesosternal lobes less strongly transverse than in *d. delicatula*; metatarsal lobes appreciably separated instead of subattingent.

Limbs more elongate than in *d. delicatula,* the femora particularly more slender; caudal femora less inflated, tapering distad more completely, evenly and less arcuately, in dorsal aspect seen to be more compressed.

*Allotype.*— ♀; same data as type. [Academy of Natural Sciences of Philadelphia].

*Description of allotype.*—The characters here given have been drawn from comparisons made with a series of average female individuals of *Stirapleura delicatula delicatula* from Trinidad, Colorado, and are solely features supplementary to those given in the description of the type male.

Head with production of fastigium and inter-antennal portion of frontal costa in profile as marked as in male sex, decidedly produced, while in the female of *d. delicatula* we find a broad and even arcuation: fastigium seen from dorsum subrostrate, with cephalic margin distinctly acute-angulate, a faint medio-longitudinal carinula indicated on the excavated portion of fastigium, which conforming to the general form of fastigium is sublanceolate.

Pronotum with lateral carinae of dorsum more arcuate clepsydral than in male sex, more regularly and broadly diverging cephalad and caudad, greatest width caudad between outer (lateral) margins of carinae being equal to approximately seven-tenths of greatest length of the pronotum (instead of in the vicinity of four-fifths as in *d. delicatula*); lateral lobes of pronotum with ventro-caudal angle less strongly angulate than in male sex of *d. buckelli,* but less broadly rounded than in female of *d. delicatula*; callose ridges of lobes distinctly indicated only between second and third sulci, and there far more weakly so than in *d. delicatula.*

*Paratypic series.*—Of the series of *buckelli* before me, aside from the type and allotype, I am considering the following British Columbian material as paratypic: Naramata, two males; Pen-

ticton, two males; Vaseaux Lake, one male; Oliver, twelve males, seven females; Fairview, two males, one female; Osoyoos, two females; Rock Creek, one male, three females; Ox Falls, one male.

*Measurements (in millimeters) of extremes or average individuals*

Typical *S. delicatula buckelli*

| | Length of body | Length of pronotum | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|
| ♂ | | | | |
| Oliver, British Columbia, *type* | 16 | 3.5 | 13.2 | 10.2 |
| Oliver, British Columbia, *paratype* | 17.2 | 3.8 | 13.8 | 11 |
| Fairview, British Columbia, *paratype* | 15.2 | 3.3 | 12.3 | — |
| Fairview, British Columbia, *paratype* | 16.2 | 3.9 | 12.9 | 11.9 |
| Rockcreek, British Columbia, *paratype* | 15.8 | 3.6 | 13.5 | 11.2 |
| Wenass, Washington | 16.8 | 4.1 | 14.2 | 11.4 |
| ♀ | | | | |
| Oliver, British Columbia, *paratype* | 20.2 | 4.8 | 15.6 | 12.2 |
| Oliver, British Columbia, *allotype* | 25 | 5 | 17.4 | 14.2 |
| Fairview, British Columbia, *paratype* | 24 | 4.9 | 17.3 | 14 |
| Rockcreek, British Columbia, *paratype* | 23 | 4.7 | 16.6 | 12.4 |
| Osoyoos, British Columbia, *paratype* | 26.5 | 4.4 | 16.7 | 14.2 |
| Osoyoos, British Columbia, *paratype* | 25.2 | 5 | 17.9 | 14.5 |

Atypical *S. delicatula buckelli*

| | Length of body | Length of pronotum | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|
| ♂ | | | | |
| Norris, Yellowstone National Park | 15 | 3.5 | 13.2 | 10 |
| Evanston, Wyoming | 15 | 3.2 | 12.8 | 10 |
| ♀ | | | | |
| Cokeville, Wyoming | 20.2 | 3.9 | 15 | 11.4 |
| Evanston, Wyoming | 21.4 | 4.3 | 16.3 | 12.4 |

From these figures it is evident that considerable individual variation in size is present in even a limited series from a single locality. The representation is too small to warrant any deductions as to local size tendencies, but it would appear that in the territory occupied by the atypical conditions of *buckelli* the general size is probably less than in regions of lower elevation and more arid conditions to the northwestward, where the typical condition of the subspecies occurs.

*Color notes.*—The general color impression one receives of the series of *S. d. buckelli* now before me is that of a more sombrely colored insect than *S. d. delicatula.* There does not appear to be the range of color tones noticed in the typical form (*S. d. delicatula*), buffs being less indicated, except that the Cokeville and Evanston atypical material is distinctly paler, more greenish buff on the pale areas, than is the case with the Okanagan Valley and Columbia Plains typical series.

The general pattern of this subspecies is so essentially the same as *S. d. delicatula* that no useful purpose would be served by describing it in detail. The general pale color tone ranges from dull cinnamon-buff and clay color to tawny-olive, occasionally (several specimens of both sexes and including the allotype) replaced in large part by pale mouse gray, thus creating a quite different general appearance. This latter condition might well be considered a minor pattern type, but it is so variable in intensity and our material is so relatively limited, I do not feel warranted in emphasizing it here. The dark tone of the pattern ranges from mummy brown to brownish black.

The color of the distal section of the caudal tibiae ranges from pale grenadine pink to weak grenadine red in the male sex, and from grenadine to weak grenadine red in the female. Teneral specimens show little or no pinkish coloring of this area. There is, apparently, little correlation of the color tone of this area with exact locality, the Oliver series alone showing an appreciable range, although the entire representation is too small for generalizations in this respect.

*Distribution.*—The area of distribution of typical *d. buckelli* known at this writing is limited to the interior region of extreme southern British Columbia and the western portion of the Columbia Plains of Washington. All of the British Columbia localities are in the lower Okanagan Valley or across a low divide to the eastward on the Kettle River (Rock Creek), a southward flowing, direct tributary of the main Columbia River. The only locality known for Washington is Pressy's, Wenass Valley, Yakima County, in the Columbia Plains at the east foot of the Cascade Range. Atypical material of *buckelli* before me from Norris, Yellowstone National Park, and Cokeville and Evanston, Wyoming shows that an area of typical or atypical *buckelli* must extend southeastward from the area in which typical condition is now known to occur, but how extensive this is, and how much of it is inhabited by marked or typical *buckelli* remains to be determined.

Altitudinally, typical *buckelli* ranges from as low as 1,000 feet above sea-level (Osoyoos) to as high as 2600 feet (Rock Creek), the Washington locality being but slightly higher (1100 feet) than the minimum here given. Curiously the localities from which I have seen atypical *buckelli* are all at considerable elevations,— 6200 feet at Cokeville, 6800 at Evanston and 7500 feet at Norris, Yellowstone Park. It is evident that these areas, although at considerable altitudes and with a basic Rocky Mountain life complex, have been profoundly affected by a biotic influence now found to the north or northwest. In a number of ways the intrusion of the Columbia Plains life element into the lower elevations of the west side of the northern Rockies is quite marked, and, as the base level of these ranges is well elevated, the penetration of this western influence to as high as 7500 feet is quite understandable. The occurrence at a number of localities on the eastern slopes of the same section of the cordilleran uplift of material intermediate between *S. delicatula delicatula* and *S. d. buckelli*, gives support to this conclusion, bringing out clearly that eastward the *buckelli* tendency is more and more dilute. Conversely the presence of similarly intermediate material at Springfield, southern Idaho and Stansbury Island, Great Salt Lake, to the westward of a portion of the area from which I have atypical *buckelli*, shows that the extension of that geographic race from the northwest, at least as far as its markedly typical or even atypical condition is concerned, is probably less broad than might be imagined. The definition of the full range of this subspecies, both typically and atypically, must await the acquisition of more information. Quite probably, however, its range in British Columbia northward of the Okanagan region will prove to be limited.

Mr. Buckell informs me that zonally in British Columbia *buckelli* does not extend beyond the Upper Sonoran life zone, which is an added reason for believing its range within the province to be very circumscribed. However, the atypical material we have examined is from both the Transition (Cokeville and Evanston) and Canadian (Norris) zones.

*Biological notes.*—The sole information we have regarding the habits of this subspecies has come from the pen of Mr. E. R. Buckell, who has published several notes on it [5] and also supplied me with certain other data. From his observations it is evident that *buckelli* hibernates during the winter in the immature condition, probably the second nymphal stage, and appears in the spring as soon as the ground is free from snow. Adults were taken by Buckell as early as April 24 (Fairview), when they were observed in considerable numbers, although snow was still present on the higher hills. They were found very active and common as early as May 4 at the same locality, and on May 19 females were first noticed ovipositing. From that time until the middle of June oviposition was at its height. In British Columbia from the latter time the insect descreased rapidly in numbers and by the end of June no specimens could be found. According to Buckell the eggs must hatch quite late in the season, as in the course of his observations extending to September 1 no immature specimens were seen later than early May. To the southward *buckelli* apparently persists later in the season, the material before me showing its occurrence as late as July 7 at Pressy's, Wenass Valley, Washington, and in the atypical condition, at the extreme southeastern points for material not clearly intermediate between *d. delicatula* and *d. buckelli,* on July 25 (Norris, Yellowstone National Park) and August 4 (Cokeville, Wyoming) and 6 (Evanston, Wyoming).

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[5] Fiftieth Ann. Rep. Ent. Soc. Ontario, p. 55, (1919); Proc. Ent. Soc. Brit. Columb., 1922, no. 20, Syst. Ser., p. 19, (1922).

The insect is very active, according to Buckell, and the males can be heard stridulating while at rest upon the ground. When disturbed they will hop away, not readily taking wing. The males are silent, however, when in flight.

The preferred habitat of this race is open stony areas among the sage brush, although it was noticed by Buckell on open bunch-grass plains. At Cokeville Hebard and Rehn found the insect in areas of short dry grasses.

*Specimens examined:* 41; 25♂, 16♀.

Typical *S. delicatula buckelli*

BRITISH COLUMBIA: Naramata, Okanagan Lake, Yale District, V, 2, 1919, (E. R. Buckell), 2♂, *paratype* [A.N.S.P.]. Penticton, Okanagan Lake, Yale District, IV, 26, 1919, (E. R. Buckell), 2♂, *paratypes* [A.N.S.P.]. Vaseaux Lake, Okanagan region, Yale District, VI, 14, (E. R. Buckell), 1♂, *paratype,* [A.N.S.P.]. Oliver, Okanagan Lake, Yale District, V, 7 and 10, 1923, (E. R. Buckell), 13♂, 8♀, *type, allotype* and *paratypes,* [A.N.S.P., Hebard Cln. and Canad. Nat. Collection]. Fairview, Okanagan region, Yale District, IV, 24, V, 4 and 19, 1919, (E. R. Buckell), 2♂, 1♀, *paratypes,* [A.N.S.P.]. Osoyoos, Okanagan region, Yale District, V, 10–11, 1923, (P. N. Vroom), 2♀, *paratypes,* [A.N.S.P.]. Rock Creek, Okanagan region, Yale District, VI, 8–10, 1923, (E. R. Buckell and P. N. Vroom), 1♂, 3♀, *paratypes,* [A.N.S.P.]. Ox Falls, Okanagan region, Yale District, VI, 3, 1919, (E. R. Buckell), 1♂, *paratype,* [A.N.S.P.].

WASHINGTON: Pressy's, Wenass Valley, Yakima County, VII, 7, 1882, 1♂, [Hebard Cln.].

Atypical *S. delicatula buckelli*

WYOMING: Norris, Yellowstone National Park, 7500 feet elevation, VII, 25, 1923, (H. C. Severin), 1♂, [Hebard Cln.]. Cokeville, Uinta County, 6200 feet elevation, VIII, 4, 1910, (R. & H.; in short dry grasses), 1♀. Evanston, Uinta County, 6800 feet elevation, VIII, 6, 1877, (S. H. Scudder), 1♂, 1♀, [M.C.Z.].

# THE CUBAN GENUS POLYANCISTROIDES

## (ORTHOPTERA: TETTIGONIIDAE, PSEUDOPHYLLINAE)

BY JAMES A. G. REHN

(Plates XXIV, XXV)

Some months ago when discussing the relationship of the Hispaniolan pseudophyllid genus *Polyancistrus,* I stated [1] that its " sole near relative . . . is the genus to which Bolivar applied the name *Pseudancistrus,* the latter unfortunately preoccupied by Bleeker's earlier use (1863) of the same for fishes, and replaced with *Polyancistroides* by Rehn in 1901. Bolivar's genus was erected to include a single species, *P. gundlachii,* which is generally distributed but rare in Cuba." On the same page I also said, " Although I know the last mentioned genus (i.e *Polyancistroides*) solely from Bolivar's description and illustrations, it clearly is generically distinct from *Polyancistrus,* and doubtless represents an extreme development of the same line. . . ."

Shortly after the *Polyancistrus* paper appeared, Mr. P. J. Darlington, Jr., of the Museum of Comparative Zoology, whose interesting discoveries were the inciting cause of my study of that genus, wrote me to the effect that he had taken a few specimens of the Cuban *Polyancistroides* in 1936, and very shortly after the four specimens were in my hands for study.

It was at once evident, as Mr. Darlington had suspected, that more than a single species was represented, and it was just as definite that neither of them was Bolivar's *gundlachii,* the genotype.

The following study is the result of my examination of this small but interesting series of one of the rarest of West Indian Pseudophyllinae, and I desire most sincerely to thank Mr. Darlington for the courtesy which permitted me to examine this most striking and distinctive genus.

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[1] Trans. Amer. Ent. Soc., LXII, p. 273, (1936).

## POLYANCISTROIDES Rehn

1884. *Pseudancistrus* Bolivar, Artrópodos del Viaje al Pacífico, Insectos, Neurópt. y. Ortópt., p. 82 footnote, pl. 3, figs. 3, 3a, 3b. (Not *Pseudancistrus* Bleeker, 1863.)
1887. *Pseudancistrus* Bolivar, Mém. Soc. Zool. France, I, p. 147.
1895. *Pseudancistrus* Brunner, Monogr. der Pseudophyll., pp. 20, 233.
1891. *Pseudancistrus* Gundlach, Contr. Entom. Cubana, II, p. 354.
1901. *Polyancistroides* Rehn, Canad. Entom., XXXIII, p. 272. (To replace *Pseudancistrus* Bolivar, not of Bleeker, 1863.)
1906. *Polyancistroides* Kirby, Synon. Catal. Orth., II, p. 342.
1909. *Polyancitroides* Rehn, Second Rep. Cent. Exper. Station, Rep. Cuba, p. 210. (Typographical error for *Polyancistroides*.)
1936. *Polyancistroides* Rehn, Trans. Amer. Entom. Soc., LXII, p. 273.

GENOTYPE (by monotypy): *Pseudancistrus gundlachii* Bolivar.

Due to certain species of the related genus *Polyancistrus* invalidating the generic value of features considered to be diagnostic of the present genus by Bolivar and Brunner, it is necessary to redefine *Polyancistroides* in the light of our present knowledge of the species of both it and *Polyancistrus*.

*Generic features.*—Brachypterous (in both sexes), tegmina merely small squamae, but little surpassing caudal margin of pronotum, wings probably lacking. Head subglobose; fastigium short, acute, not surpassing antennal scrobes, subsulcate medio-longitudinally; proximal antennal article with an erect spine disto-internal, remainder of antennae at least twice as long as body. Pronotum short, sellate, dorsum subdeplanate, transverse sulci deeply impressed; cephalic margin with an erect median spine, lateral and caudal margins with numerous radiating spines of two lengths; lateral lobes vertical, inserted at right angles, subtruncate ventrad. Stridulating field occupying most of the tegmina of the male. Prosternum, mesosternum and metasternum bispinose. Male cerci simple, with briefly recurved hook-like apices. Ovipositor of female arcuate, margins narrowing, entire, apex acute. Femora incrassately robust, particularly in the male sex, surface sparsely scabroso-spinulose, ventro-cephalic margin with several marked spines, of which that mesad on the median and cephalic pairs is very marked in the male, this series uniformly very long on the caudal femora, genicular lobes strongly spined: tibiae deplanate dorsad, biseriately spinose ventrad, these larger on cephalic side of all tibiae and the median one of this series on cephalic pair greatly elongate, extensor surface of caudal tibiae with spines greatly developed and very long.

*Distribution.*—Apparently distributed over a large part of Cuba, although no definite information is available on its occurrence in the central part of the island. The only known data on altitudinal distribution accompany the present material, and indicate elevations ranging from one thousand to between three and four thousand feet above the sea.

*Remarks.*—When compared with the Hispaniolan genus *Polyancistrus* the present one can at once be distinguished by the lesser development and non-bulbous character of the metazona of the pronotal disk, the spinoso-scabrose femora, the pronounced development of a median spine on the ventro-cephalic margin of the cephalic and median femora and tibiae and the very marked biseriate[2] character of the spines of these same margins. Numerous other features will separate *Polyancistroides* from the macropterous forms of *Polyancistrus,* but the brevialate and brachypterous members of that genus break down virtually all the supposed generic differentiations given by Bolivar except the disposition of the femoral and tibial spines.

The pronotal form is consistently different in *Polyancistroides* from what we find in *Polyancistrus,* never showing the lanceolate or the bulbous bullation always making up the metazona of the disk in the Hispaniolan genus. Such bullation as is seen in *Polyancistroides* is slight and restricted.

The character of the spination of the limbs in *Polyancistroides* is probably its most distinctive feature, the biseriate and mantoid type found on the cephalic and median limbs having no parallel or analogue in *Polyancistrus.* Taken with the robust character of the cephalic and median femora this condition may indicate in part at least a predaceous mode of life, such as we know is found in a number of other tettigoniids.

Owing to the great rarity of the few specimens seen of the present genus I have not drawn upon characters which would require dismemberment or unwarranted relaxation of the material. In consequence I have not used the form of the stridulating field of the male tegmina as a diagnostic feature, although there appears to be some value to it. I have, however, made some notes on the same in the respective descriptions using evidence visible without further relaxation.

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[2] I use the word "biseriate" to express a spine series composed of elements of two different lengths, whether grouped by length or alternate.

*Relationship and origin.*—In discussing the related genus *Polyancistrus* I pointed out that the brachypterous members of that genus show a definite approach toward *Polyancistroides*, represented particularly by *Polyancistrus abbottii.*[3] At this writing, with a knowledge of *Polyancistroides* then not possessed, I wish to re-affirm that conclusion, yet to indicate as well that the two genera, while having a common ancestry, are quite distinct and apparently have developed independently over a considerable period of time. In endeavoring to trade the geological background for these genera, I then pointed out[4] that Schuchert concluded the last connection (direct or indirect) between Hispaniola and Cuba was not more recent than the Lower Oligocene. This would postulate a relatively old ancestral segregation of the two genera, and thus give a lengthy period for the evolution of each as we know them today. The localization of the species of *Polyancistrus* more nearly related to *Polyancistroides* in the southwestern peninsula of Haiti, which formed part of the Honduranian-Antillean land bridge, rather than in the northwestern one, which more nearly approaches Cuba, shows the interpretation of the evolutionary history of these genera is not simple. The complete absence, as far as known, of any member of this complex of genera from Jamaica, through which island, according to the historical geologists, the last connection of Cuba and Hispaniola existed, is also puzzling, when we realize that the southwestern Haitian peninsula is unquestionably part of this ancient land-bridge.

A full understanding of the history and movements of these genera, as with so many others, must await more detailed information on the distribution of the existing forms, and a more exhaustive geological understanding of the Antillean region. It is increasingly evident, however, as our knowledge of the animal life of that area becomes more comprehensive, that the Antillean fauna has in part at least gone through a considerable evolution since it reached its present geographic location, and that numerous of the autochthonous elements developed there.

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[3] Trans. Amer. Ent. Soc., LXII, p. 273, (1936).

[4] Trans. Amer. Ent. Soc., LXII, pp. 312–313, (1936).

### *Key to the species of Polyancistroides* [5]

1. Median spine on cephalic margin of pronotum shorter, non-aciculate. Penultimate abdominal tergite of male with its paired distal marginal lobes rectangulate. Ultimate abdominal tergite (supra-anal plate) of male narrower proximad than long, sublanceolate. Caudal femora with ventro-external spines less elongate, more oblique in direction, caudal tibiae with spines of extensor margins shorter. (Cephalic femora markedly inflated, relatively crab-like.)...*carcinus* new species

Median spine on cephalic margin of pronotum more elongate, distinctly aciculate. Penultimate abdominal tergite of male with its paired distal marginal lobes obtuse. Ultimate abdominal tergite (supra-anal plate) of male broader proximad, at least as broad as median length, linguiform. Caudal femora with ventro-external spines more elongate (at least in *xanthicles*), more vertical in direction; caudal tibiae with spines of extensor margins longer.................................2

2. Pronotum with median spine of caudal margin of disk hardly if at all longer than the more lateral spines on the same margin. Cephalic femora much less strongly inflated and not as distinctly crab-like. Limbs as a whole more slender................*xanthicles* new species

Pronotum with median spine of caudal margin of disk markedly longer than the more lateral spines on the same margin. Cephalic femora markedly inflated and distinctly crab-like. Limbs as a whole more robust. ..................................*gundlachii* (Bolivar)

**Polyancistroides carcinus** [6] new species

(Pl. XXIV, figs. 1 and 2; pl. XXV, figs. 6 and 7.)

In the preceding key I have given the most striking diagnostic features to separate this species from both *P. xanthicles* and *gundlachii*. However, it should be realized that *carcinus* and *gundlachii*, while differing in a number of features expressed in the key, agree in having the limbs, and particularly the cephalic and median femora, heavier, more inflated and more carcinoid in appearance than in *xanthicles*. Additional features of difference from *xanthicles* are the less marked development of the peripheral spination of the pronotal disk, both lateral and caudal, the individual spines being shorter, the more vertical and less oblique principal sulcus on the lateral lobes of the pronotum, the less pronounced seriate scabroso-spination of the dorsal (extensor) surfaces of all the femora, the shallower distal emargination of the ultimate tergite (subgenital plate) of the male, as well as the lack of a contrasted abdominal color pattern.[7]

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[5] As explained in the discussion, the features given for *P. gundlachii* (Bolivar) have been drawn entirely from Bolivar's original descriptions and figures, the former of which are not as detailed as could be desired, and the latter sketchy and clearly inaccurate in certain respects (i.e. failure to show the division between the ultimate and penultimate abdominal tergites). The future acquisition of material of *gundlachii* may, in consequence, make necessary a recasting of this key, but it will suffice to show the very evident distinctness of *carcinus* and *xanthicles* from *gundlachii*, as well as from one another.

[6] From Καρκίνος, *a crab*, in allusion to its crab-like cephalic and median femora.

The median spine of the cephalic margin of the pronotum of the type of *carcinus* has, it is evident, been slightly damaged apically in the unique type, but it is equally apparent from the size and thickness of the undamaged remainder that this structure is, as a whole, distinctly more slender and doubtless always much shorter than in *P. xanthicles.*

*Type.*—♂; Sierra de Rangel, Pinar del Rio Province, Cuba. Elevation about 1500 feet. August 23, 1936. (P. J. Darlington, Jr.). [Museum of Comparative Zoology].

Head short, relatively broad, face subdeplanate, head somewhat broader across the ventral sections of the genae than across the eyes, gradually widening ventrad as seen in cephalic aspect: eyes globose, diameter subequal to length of proximal article of antennae, moderately exserted: antennae nearly three times as long as the body, disto-internal spine of proximal article but slightly shorter than half the length of the article: palpi with ultimate article to antepenultimate as 5.5 to 3.5, the penultimate as 2.5, all slender, the ultimate quite slender proximad, subclavate distad.

Pronotum with greatest width of cephalic margin (exclusive of spines) subequal to median length of prozona, median length of metazona slightly greater (as 10 to 8.5): cephalic margin as seen from dorsum obtuse-angulate, medio-cephalic spine vertically directed, not projecting cephalad, acuminate but non-aciculate; lateral margins of disk with three spines on each side cephalad of the anterior sulcus, two on each side between the anterior and principal sulci and seven to eight on each side caudad of the latter, aside from the mediocaudal spine, approximately four of this group on each side of a larger category than the others, medio-caudal spine damaged, apparently extending directly caudad; surface of disk subconcave mesad, cephalad of anterior sulcus definitely ascendant dorso-cephalad, caudal half of metazona sub-bullately convex, sharply cut-off from the subconcave cephalic half of the same area, no median carina present, transverse sulci, and particularly the principal one, markedly incised: lateral lobes of pronotum with average depth equal to seven-tenths of the ventral length of the same, sulci deeply impressed, the principal one profoundly severing the lateral margins of the disk.

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[7] As the type of *carcinus* is unique I am unable to say whether the lack of an abdominal pattern is a bona-fide specific feature. The type has been dried from a liquid preservative, but so apparently have the type and allotype of *xanthicles,* and all were collected within a period of a month and less than a year ago. My inclination is to consider the pattern difference a specific feature.

Tegmina extending caudad of the pronotum a distance not more than one-fourth of the tegminal length when seen in lateral view, as a whole transverse when seen from dorsum: costal margin arcuate, distal extremity rather narrowly rounded; humeral trunk pronounced only in proximal half of tegmen; lateral elevated rim margining stridulating field distinct and well elevated but not high, even in elevation, rounding down to sutural margin distad, joining this briefly proximad of apex of tegmen; stridulating vein straight transverse, producing distad a moderate lobate proximal expansion of the sutural margin, the latter concave distad of this point; speculum moderately transverse, greatest length to greatest width as 3 to 4, bounding veins straight transverse proximad, straight longitudinal suturad, mesad and distad broadly and evenly arcuate. Wings apparently absent.[8]

Penultimate abdominal tergite strongly transverse, distal margin of same with the median emargination rectangulate, the angles laterad of the same lobate rectangulate, thence laterad of the lobations the margin is concavely emarginate; medio-longitudinally the surface of tergite is sulcate, more obsoletely so proximad, forming the center of a subquadrate glandular area clothed with numerous, rather long soft hairs; ultimate tergite (supra anal plate) sublanceolate, slightly longer than broad proximad (as 3.5 to 3), apex narrowly rounded, surface longitudinally excavate, haired at proximal bases: cerci short, relatively stout, straight with apices briefly and sharply hooked, surface of cerci except of tips with numerous short erect chaetulae: ultimate sternite (subgenital plate) not surpassing distal margin of ultimate tergite, shallowly scoop-shaped, in profile its lower line is nearly straight, lateral margins, as seen in ventral aspect, straight convergent to the narrow, intercercal distal margin, which is biconvex; styles short, subequal in length to distance between stylar bases, tapering, blunt acute.

Cephalic femora in length equal to one and three-fifth times that of pronotum, appreciably inflated, subfusiform, greatest depth in profile equal to one-fifth of the length, surface of extensor face with trilineately disposed series of marked but adpressed dentate tubercles, lateral faces with shallowly impressed surface sculpture of numerous transverse muscle attachments; cephalic flexor margin with a large median suberect spine, followed distad after a considerably diastema by a group of three shorter, proportionately more robust spines, spine of cephalic genicular lobe larger than that of external: cephalic tibiae faintly longer than corresponding femora, quadrate in section, extensor margins rather closely crenulate, caudal flexor margin with three widely spaced spines of moderate length in distal half and two or three similar spaced but shorter spines in proximal half, the immediate margin crenulate, cephalic flexor margin with six to seven spaced spines of which the third from the distal extremity is three times and the second from the same point is twice the length of the others, caudal flexor margin with two or three closely placed short distal spines. Median femora similar to but a sixth shorter than the cephalic ones, surface sculpture similar to same, flexor marginal spination as on cephalic femora except that the median one of cephalic margin is distinctly smaller although exceeding other in the series in size: median tibiae with seven spines on cephalic flexor margin, fifth from base larger than others, caudal flexor margin with three distal spines, extensor margins unspined except for a single median one on the caudal side. Caudal femora faintly more than twice the length of the pronotum, of the type usual in the Polyancistri, the dorsal surface in greater part biseriately brevispinose, lateral surface dorsad with numerous spaced spiculate raised points and ventrad sculptured by numerous transverse muscle attachment points, internal genicular lobe with a slightly longer spine than the external, external-flexor margin with seven to nine marked, oblique, spaced spines, internal-flexor crenulate with one or two short distal spines: caudal tibiae slightly longer than the femora, quadrate in section, all margins crenulate, external extensor with six, internal extensor with eight spined spines, the internals distinctly longer than those of the external series, flexor margins with eleven to twelve external and three to fourth distal ones on the internal side.

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[8] As far as can be seen beneath the tegmina of the type the mesonotum bears no traces of wing nodes.

Coloration virtually destroyed by immersion in liquid preservative, solely certain pattern features being left. These are dark distal portions to all the pronotal and limb spines and tips of the cerci, a reddish brown wash of much of the stridulating area of the left tegmen, and a tendency toward transverse barring distad on most of the abdominal tergites.

Length of body, 36.3 mm.; length of pronotum, 11.2; greatest width of disk of pronotum (not between spine tips), 6.3; length of tegmen, 5; greatest width of stridulating field of tegmen, 4.3; length of cephalic femur, 16.5; length of caudal femur, 23.5.

The type of this species is unique.

### **Polyancistroides xanthicles**[9] new species

(Pl. XXIV, figs. 3-5; pl. XXV, figs. 8 and 9.)

In the key to the forms of the genus I have given the features which will most readily separate the present species from *carcinus,* in addition to which under the diagnosis of the latter species will be found other, less pronounced characters which also distinguish the two species. The features contrasting *xanthicles* and *gundlachii* in the key have, of necessity, been drawn for the latter species entirely from Bolivar's original description and illustrations. Whether the emphasis here placed on these characters is fully warranted must await the comparison of material of the two species. Unless Bolivar completely misstated the characters of his species and his illustrations were incorrectly drawn, *gundlachii* has a far more elongate median spine on the caudal margin of the pronotal disk, as well as much heavier cephalic femora, than either of the species of the genus now before me.

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[9] From Ξανθικλῆς, *a commander of the Ten Thousand.*

*Type.* — ♂; Mountains north of Imias, eastern Oriente Province, Cuba. Elevation, 3000-4000 feet. July 25-28, 1936. (J. J. Darlington, Jr). [Museum of Comparative Zoology].

The characters here given are largely comparative with the preceding description of the male sex (*type*) of *P. carcinus.*

Proximal antennal article with disto-internal spine two-thirds as long as the article, more robust and elongate than in *P. carcinus.*

Pronotum with medio-cephalic spine of cephalic margin elongate aciculate, its length as a spine subequal to that of each lateral half of the cephalic margin; lateral margins of disk with three to five (sinistral side) spines on each side cephalad of anterior sulcus, the caudal one the longest, three to four between the sulci, the cephalic and caudal of which are the longer, and seven to eight on each side caudad of the principal sulci, five of these of the larger category, medio-caudal spine no longer than those of the major lateral category, not elevated; surface and lateral lobes as in *P. carcinus.*

Tegmina as in *P. carcinus* except that they project caudad of the pronotum to a slightly greater extent, have the sutural margin less sharply arcuate protuberant about the distal end of the stridulating vein and have the disto-sutural section of the bordering margin of the speculum more broadly arcuate, while the proximo-humeral border of same is more sharply rectangulate.

Penultimate abdominal tergite with distal margin broadly but shallowly concavo-emarginate in median half, the angled lobations laterad of the same obtusely rounded; surface of tergite with impressed area mesad more deeply deflexed than in *P. carcinus*, the depression more marked but less thickly haired than in that species; ultimate tergite (supra-anal plate) broader, more trigonally linguiform, its greatest proximal width subequal to the median length, apex rounded acute, median sulcation marked only proximad: cerci as in *P. carcinus*: ultimate sternite (subgenital plate) as in *carcinus*, but distal margin broadly V-emarginate between cercal bases.

Cephalic femora in length equal to one and one-half times that of pronotum, less inflated than in *P. carcinus*, spination as in latter but chief (median) spine of cephalic flexor margin longer and more vertical than in *carcinus*: cephalic tibiae with caudal flexor margin with seven to eight spaced small spines, cephalic flexor margin with seven to eight spaced spines, the second and third from the distal extremity as in *carcinus* in relative length but the former is more erect. Median femora spined as in *carcinus* except that the large median spine of the cephalic flexor margin is larger proportionately, nearer the size of the larger one of the same margin of the cephalic femora, a small supplementary spine present briefly proximad of the large one: median tibiae with cephalic flexor margin as in *P. carcinus*, the caudal with six spaced spines, those distad the larger, caudal flexor margin with three spaced spines in proximal half, the distal unarmed. Caudal femora with nine spines on the external flexor margin, all but distal and proximal ones quite long, more vertical than in *P. carcinus* and with tips appreciably curved, internal flexor margin unarmed except for two very small distal spinules: caudal tibiae with twelve spines on external flexor margin, between same is crenulate as in *P. carcinus*; internal flexor margin with five to eight spaced, relatively small spines; external extensor margin with eight, internal with nine, distinctly longer spines.

*Allotype.*— ♀ ; Yunque de Baracoa, Oriente, Cuba. Elevation, 1000-1800 feet. July 13, 1936. (P. J. Darlington, Jr.). [Museum of Comparative Zoology].

Differing from the above description of the male (type) in the following noteworthy features.

Pronotum showing some accidental injury on dextral side, so that the marginal spine development and surface sculpture are unbalanced.

Tegmina of the same length and of nearly the same general outline seen in the male, the dorsal area of left tegmen developed as a part of a definite but not strongly modified stridulating organ without a stridulating vein or speculum, and lacking the bounding lamellate ridge seen in males of this genus and *Polyancistrus*, but with the diagonal intra-sutural vein strongly accentuated, straight except distad, and with its dorsal surface bearing a marked rasp, width of dorsal area less than in male and its sutural margin not lobate produced proximad; marginal field similar to and as wide as in male.

Penultimate abdominal tergite similar in general type to that of male, its distal margin concavo-emarginate mesad with low obtuse-angulate lateral bounding lobulations somewhat more distant from one another and more rounded than in male, median glandular impression present but less extensive than in male: ultimate tergite (supra-anal plate) proportioned as in male but more sharply trigonal, margins less rounded and apex sharper:

cerci not surpassing apex of ultimate tergite, stout, strongly tapering, briefly incurved distad: ovipositor subequal in length to cephalic femora, gently arcuate, regularly narrowing, apex acute, margins entire: ultimate sternite (subgenital plate) trigonal in general shape, broadly and deeply U-emarginate distad, bounding angles acute.

Limbs as a whole more slender than in male although similar in length and in surface sculpture, as well as spination details except that all spines are somewhat less strongly developed, particularly the median ones of the cephalic flexor margins of the cephalic and median femora and tibiae, which are hardly longer than the others on the same margin, caudal femora with spines appreciably less strongly developed than in male, more oblique and less vertical, equally curved at apices.

*Coloration.*—Coloration somewhat modified by immersion in liquid preservative, but sufficient is present to indicate pattern. Base color cinnamon-buff to sayal brown overlaid with a pattern of mummy brown distributed as follows: face with two transverse clouds, genae with a clouded spot, occiput washed with same, dorsum of pronotum broadly clouded leaving areas of the pale base color (see plate XXIV, fig. 4), tegmina of female largely dark, the abdominal tergites bearing paired lateral, longitudinally disposed double chevron-like markings, the angles pointing mesad, the outer series of less bulk than the inner (see plate XXIV, figs. 3–5). Limbs washed with tawny, varying in depth, deeper in female, the immediate apices of the femora relatively pale, the tibiae washed to a variable degree with mummy brown in female, in male little darkened, tibial spines on flexor surfaces narrowly tipped with same color, largely fuscous on extensor surfaces, femoral spines on flexor surfaces fuscous tipped, the larger ones frequently dark annulate proximad as well. Ovipositor briefly pale proximad, in greater part dark prout's brown. Antennae multiannulate with dark.

*Measurements (in millimenters)*

| | Length of body | Length of pronotum | Greatest width of disk of pronotum | Length of tegmen | Greatest width of dorsal field of tegmen |
|---|---|---|---|---|---|
| ♂, *type* .......... | 37.2 | 11.3 | 6.2 | 5.5 | 4.2 |
| ♀, *allotype* ....... | 41 | 8.8 | — | 5 | 3.4 |

| | Length of cephalic femur | Length of caudal femur | Length of ovipositor |
|---|---|---|---|
| ♂, *type* .......... | 16.3 | 22.5 | — |
| ♀, *allotype* ....... | 14.8 | 25.5 | 17.6 |

In addition to the type and allotype I have before me an immature female, presumably in the second instar preceding maturity, bearing the same data as the allotype. This individual is completely decolored from liquid preservative.

**Polyancistroides gundlachii** (Bolivar)

1884. *Pseudancistrus gundlachii* Bolivar, Artrópodos del Viaje al Pacífico, Insectos, Neurópt. y Ortópt., p. 82 footnote, pl. 3, figs. 3, 3a, 3b. [♂ (type), juv. ♀ ; Cuba.]

1887. *Pseudancistrus gundlachi* Bolivar, Mém. Soc. Zool. France, I, p. 149. [Cuba.] (Nothing further added.)

1895. *Pseudancistrus gundlachi* Brunner, Monogr. der Pseudophyll., p. 233. [Cuba.] (Nothing additional to Bolivar.)

1891. *Pseudancistrus gundlachi* Gundlach, Contr. Entom. Cubana, II, p. 354. [Western and eastern Cuba.] (Redescribe species.)[10]

1906. *P[olyancistroides] gundlachi* Kirby Synon. Catal. Orth., II, p. 342. [Cuba.] (Nothing additional to Bolivar.)

1909. *Polyancitroides* [sic] *gundlachi* Rehn, Second Rep. Cent. Exper. Station Rep. Cuba, p. 210. (Quotes from Gundlach.)

This species is known to me only from Bolivar's original description and figures, which constitute the total authoritative data we have on the species. The exact locality in Cuba from which the type came is not known, and Gundlach, from whom it was received by Bolivar, stated he had taken it in the western as much as in the eastern part of the island, and that it is very rare, at least in the adult condition. The probability is that Gundlach collected more than a single species of the genus, and that the various forms of *Polyancistroides* are relatively localized in distribution. Gundlach's comment was responsible for my statement of 1936[11] that *P. gundlachii* " is generally distributed but rare in Cuba."

For the sake of completeness and to aid future students, as the work in which Bolivar's specific description appeared is a rather rare volume, I am quoting in full his original description of *gundlachii.*

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[10] It is quite probable that Gundlach had before him one or both of the species here described, as well as true *gundlachii.*

[11] Trans. Amer. Ent. Soc., LXII, p. 273, (1936).

" Nitidiusculus, virescens. Pronoti margine antica erosa, disco subrugoso, transversim bisulcato, postice elevato; carinis lateralibus plurispinosis. Femoribus supra scabrosis; anterioribus apice subtus bifariam spinosis, carina interna medio spina validissima armata; posterioribus carina inferiori-externa spinis magnis, interna tantum apicem versus spinosa, tibiis anticis medio spina validiori, intermediis supra spinosis: posticis quadrifariam spinosis. Lamina supra-anali transversa, processo brevi, trigono; cercis brevissimus, apice intus subcurvatis; lamina infra-anali apice angustata; stylis brevibus ♂."

" Long, corporis .............. 0, m 040
" — pronoti .............. 0,011
" — femor. post. .......... 0,024."

## Explanation of Plates

### Plate XXIV

Fig. 1.—*Polyancistroides carcinus* new species. Lateral view of male (*type*). Sierra del Rangel, Pinar del Rio, Cuba. (Natural size.)

Fig. 2.—*Polyancistroides carcinus* new species. Dorsal view of male (*type*). Sierra del Rangel, Pinar del Rio, Cuba. (Natural size.)

Fig. 3.—*Polyancistroides xanthicles* new species. Lateral view of male (*type*) Mountains north of Imias, Oriente, Cuba. (Natural size.)

Fig. 4.—*Polyancistroides xanthicles* new species. Dorsal view of male (*type*). Mountains north of Imias, Oriente, Cuba. (Natural size.)

Fig. 5.—*Polyancistroides xanthicles* new species. Lateral view of female (*allotype*). Mountains north of Imias, Oriente, Cuba. (Natural size.)

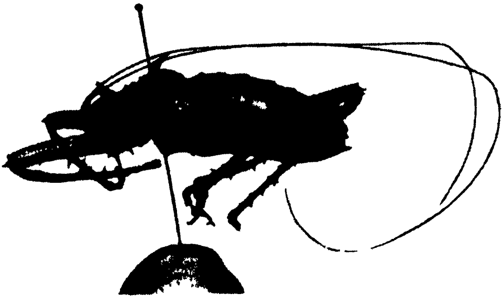
### Plate XXV

Fig. 6.—*Polyancistroides carcinus* new species. Cephalic limb of male (*type*). Sierra del Rangel, Pinar del Rio, Cuba. (× 2⅓.)

Fig. 7.—*Polyancistroides carcinus* new species. Caudal aspect of anal orifice of male (*type*). (Much enlarged.)

Fig. 8.—*Polyancistroides xanthicles* new species. Cephalic limb of male (*type*). Mountains north of Imias, Oriente, Cuba. (× 2⅓.)

Fig. 9.—*Polyancistroides xanthicles* new species. Caudal aspect of anal orifice of male (*type*). (Much enlarged )



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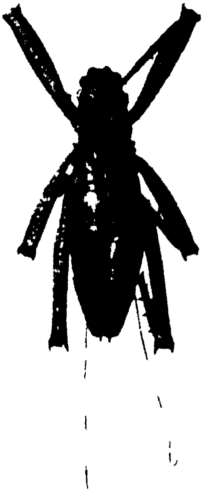

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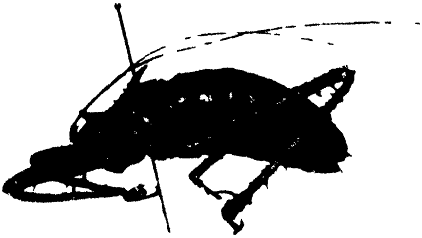

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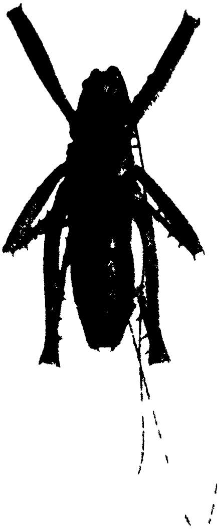

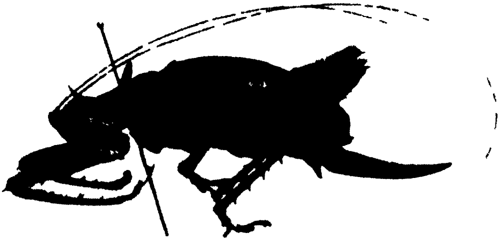

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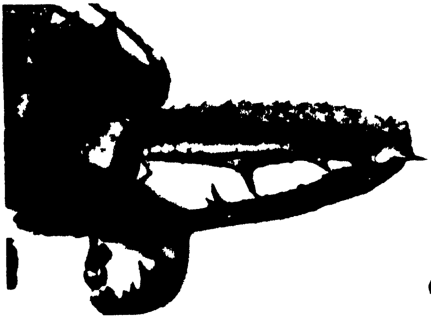
REHN--CUBAN POLYANCISTROIDES



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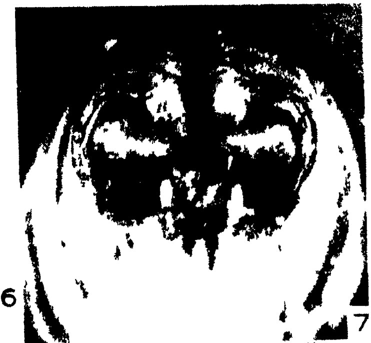

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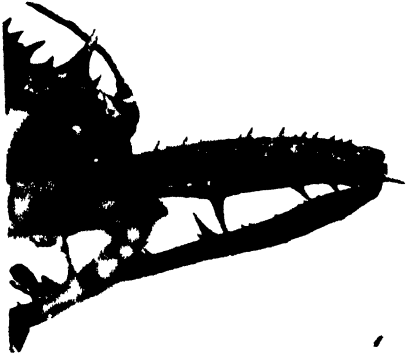

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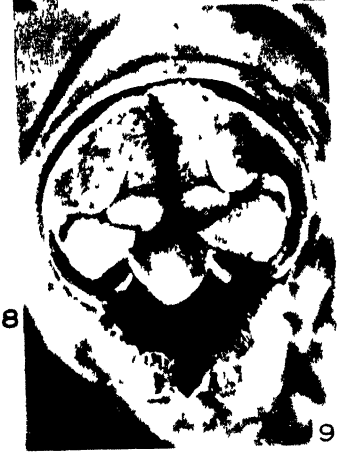

9

REHN—CUBAN POLYANCISTROIDES

# STUDIES IN ORTHOPTERA WHICH OCCUR IN NORTH AMERICA NORTH OF THE MEXICAN BOUNDARY

BY MORGAN HEBARD

(Plates XXI to XXII)

In 1934 the present series of papers was begun[1] in order to place in the literature the still undescribed species and races which I realized existed in this region and to establish certain synonymy. The list of Orthoptera is now well advanced, but there is still considerable to be done before publication would seem advisable.

## VII. NOTES AND A NEW SPECIES OF TIMEMA, AND A NEW RACE OF DIAPHEROMERA VELII, (PHASMIDAE)

The recent receipt of a specimen of *Timema* from the mountains of southeastern Arizona comes as a decided surprise, as the genus was previously known only from the forested high mountains of California west to the Pacific Coast.

My prior attempt to bring order out of the confusion surrounding *Diapheromera velii* was seriously marred by failure to assign properly the immatures which had been described as *mesillana*. Study of additional material leads me to place that name as a synonym and the southwestern race which I had recognized must not only be described but its distribution must be corrected.

### **TIMEMA** Scudder

Since I revised this genus[2] an additional species has been added.[3] The four species now recognized may be distinguished as follows:

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[1] All of these have appeared in the present publication as follows: LIX, p. 363, I on *Psychomastax*, p. 371, II on *Cyphoderris*; LX, p. 31, III on the Decticinae, p. 281, IV on *Diapheromera*, p. 284, V on the Pachymorphinae; 1936, LXII, p. 231, VI on *Arethaea*.

[2] Ent. News, XXXI, pp. 126 to 132, figs. 1 and 2, (1920).

[3] Strohecker, Ent. News, XLVII, pp. 267 and 268, figs. 1 and 2, (1936). In figure 1 the minute tooth proximad on the internal margin of the male sinistral cercus is not shown on the shaft as it should be, being apparently misplaced and shown dextrad and very much too large.

### Males

1. Dextral cercus simple. (Sinistral cercus with a minute proximo-internal tooth and a broad medio-internal flange with inner margin convex to the minute acute apex.) Southern Sierra Nevada Mountains, California. ........................................ *podura* Strohecker

   Dextral cercus with a disto-internal flange.......................... 2
2. Sinistral cercus (with a minute proximo-internal tooth) slender, with a disto-internal flange which is similar to but smaller than that of dextral cercus. Coastal California south to Monterey County and the Sierra Nevada Mountains south to the Kings River. *californicum* Scudder

   Sinistral cercus much heavier, with flange not distal................. 3
3. Sinistral cercus without a minute proximo-internal tooth, with a proximo-internal flange which is large and acute-angulate produced and directed meso-caudad. Sierra Madre, (probably San Bernardino) and San Jacinto Mountains, California...................... *chumash* Hebard

   Sinistral cercus with a minute proximo-internal tooth, with a medio-internal flange which is narrow with its inner margin straight to the minute acute apex. Santa Rita Mountains, Arizona. *ritensis* new species

### Females

1. Penultimate tergite produced with distal margin not bilobate......... 2

   Penultimate tergite produced with distal margin feebly bilobate (thus showing moderate angulate-emargination mesad). *californicum* Scudder
2. Distal margin of this production truncate........... *podura* Strohecker

   Distal margin of this production convex.............. *chumash* Hebard

The female of *ritensis* is not known. Whether the dorsal surface is tuberculate or smooth appears to have no diagnostic value, though such tuberculation is a striking feature in all of the males of the genus before me.

All of our series of *californicum* were dull green in life (except possibly some of those in which immersion in alcohol has destroyed their original ground color, as is also the condition of the " Los Angeles County " series of *chumash*), but among these the female from Carmel in Monterey County and to a less degree the male from that locality and the female from Paradise Valley on the King's River, show submarginal markings of dark brown. All of the specimens of *podura* and *ritensis* are light buffy brown suffused and marked with blackish brown, showing some ochraceous-tawny.

The proper sequence of the species would appear to be: *californicum* (Scudder), *ritensis* new species, *podura* Strohecker and *chumash* Hebard.

Little is yet known of the life history and habits of the species of this unusually distinctive genus. Once individuals were secured in considerable numbers by beating fir trees; one was swept from *Ceanothus* sp. Individuals have been taken from sea level up to 9432 feet.

Only the following unrecorded material has been received since 1920.

**Timema californicum** Scudder

Ross, Marin County, California, IV, 28, 1918, (J. C. Bradley), 3 ♂, 2 ♀, [Cornell Univ. and Hebard Cln.].

**Timema chumash** Hebard

San Jacinto Mountains, California, VI, 30, 1933, (R. H. Beamer), 1 ♂, 3 ♀, [Univ. of Kansas and Hebard Cln.]

**Timema ritensis** new species (Pl. XXI, fig. 1.)

This insect is nearest *podura* Strohecker of the southern Sierra Nevada Mountains in California. It is easily distinguished by the features given in the present key.

*Type.*—♂; Old Baldy, Santa Rita Mountains, Arizona. Elevation 9432 feet. July 6, 1936. (R. A. Flock; dead on steps of lookout cabin).[4] [Hebard Collection, Type no. 1317].

Size moderately large for this genus of very small walking-sticks; form robust, averaging more so even than in the most robust previously known species, *chumash.* Dorsal surface glossy, without trace of tuberculation. Cephalic margin of pronotum with lateral concavities, behind swollen post-ocular areas of head, very broad and shallow, more so than in *podura* and much less conspicuous than in *californicum* and *chumash.* Apterous. Penultimate tergite much as in the other species; rounded rectangulate production above base of dextral cercus with inner portion of dorsal surface thickly toothed. Supra-anal plate minute, rounded shield-shaped, situated just sinistrad of a median line. Dextral cercus an elongate moderately heavy cylindricad and evenly incurved shaft with internal surface flattened and produced at apex in a small rounded lamella. Sinistral cercus fairly broad, slightly incurved with apex rounded, dorsal surface flattened; a minute tooth present at base on inner side; the inner margin lamellate produced mesad, this gradually widening to its acute apex but narrow throughout. Sinistrad of the dextral cercus and occupying over half the area between the cercal bases is a large process which almost immediately becomes lamellate, is briefly produced directly caudad and then is bent strongly sinistrad, its margins in that large section almost straight, feebly divergent and rounding into the transverse apex, the dextral of these minutely toothed, this process longer than the dextral cercus. Above the base of this process is a short heavy rounded process. Subgenital plate with surface moderately convex, then moderately concave to the finely thickened evenly convex distal margin. Styles absent. Limbs heavy for the genus.

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[4] I believe that, like the other species of *Timema*, this insect appears adult in the Spring. As the summit of this mountain is a bald with much eroded granite where small clumps of oak about a foot high grow, I further believe that it will be found among the latter unless the present specimen had been accidently carried up from the forest below.

*Measurements.*—Length of body 12.7, length of pronotum 2., width of pronotum 3.7, length of caudal tibia 4. mm.

*Coloration.*—Generally light buffy brown. Antennae ochraceous-tawny, lateral margins of pronotum largely of this color and flecks of the same on margins of all tergites. Head with flecks and cheeks entirely blackish brown, this continued as a broad dorso-lateral band narrowing on abdomen and interrupted by symmetrically placed flecks of light buffy brown. Another symmetrically arranged rows of blackish brown flecks on abdomen and some marbling of the same on entire dorsum. Limbs and ventral surface very light buffy brown marbled and finely tessellate (the latter particularly on abdomen) with dark brown.

**Diapheromera velii eucnemis** new subspecies. (Pl. XXII, figs. 1 and 2.)

1931. *Diapheromera veliei mesillana* Hebard in part not *mesillana* Scudder), Ent. News, LXII, p. 65, fig. 2, (Lateral, view of male poculum.) [Robstown, Texas [5].]

When studying the species of this genus which are present in Kansas, I found in 1931 that the literature for some of the western forms was chaotic and attempted to separate what appeared then to be a southwestern race of *velii* as *mesillana*.[6] Study not only of our entire collections but also of important material belonging to the National Museum and the Museum of Comparative

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[5] The only locality quoted where *velii eucnemis*, though discussed and figured, occurs typical.

[6] At that time *Bacunculus texanus* Brunner was placed as a synonym in error. I can now state, from more complete evidence, that it is instead a synonym of *persimilis* Caudell.

Zoology now enables me to state that *mesillana* must be placed as a synonym of *velii velii* (the original material was immature, but adult material from the vicinity of Mesilla, New Mexico, I have reason to believe, will be found to be representative though probably slightly atypic of that race).

Though the race here described occurs in southwestern Texas, I find that *velii velii* occurs down the Rio Grande as far as El Paso (though atypic there) while to the north of the range of *velii eucnemis* a considerable area is occupied by an intergrading condition, agreeing with *velii velii* in the shape of the male poculum and female cerci but with *velii eucnemis* in size and in females in the coloration of the femoral apices.

*Type.*— ♂ ; Marathon, Texas. Elevation 3900 feet. September 12 and 13, 1912. (Rehn and Hebard). [Hebard Collection, Type no. 1311].

Agrees closely with typical *velii velii* except in the larger size and proportionately decidedly larger and more bilobate (in caudal aspect) lip of the poculum.[7] Size large, form slightly but definitely more robust compared with related species of the genus. Head shorter than pronotum, its length about equal to the width at and (including) the small protuberant eyes, lacking occipital horns. Seventh tergite moderately enlarged except in short proximal portion, its disto-ventral angles produced and acute angulate, its dorsal length about one-fifth greater than that of the ninth tergite; eighth tergite moderately transverse, slightly more than half as long as ninth tergite. Cercus simple, with a very minute sharp proximo-internal spine, shaft moderately elongate, curving evenly inward, enlarging very faintly distad to the rounded apex. Poculum as in *velii velii*, symmetrical though bent slightly sinistrad, differing in that nearly dorsal half of the distal portion is formed by the large lip, which curves dorso-caudad and the dorsal (distal) margin of which is bilobate in caudal aspect, the median portion of that margin showing a feebly obtuse-angulate rounded emargination. The genitalia embraced by the poculum are seen to be covered by a chitinous plate, convex dorsad and with a prominent node projecting sinistrad. Cephalic femora approximately equal in length to combined length of pronotum and mesonotum, slender and curving past head proximad. Median femora decidedly thickened, with surface longitudinally grooved and bluntly carinate, the ventral median carina armed with a very heavy swollen subapical ventro-external tooth but not elevated beneath this tooth. Caudal femora similar but decidedly less strongly specialized with homologous tooth very much longer and more slender.

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[7] Females, as discussed below, show two other striking differences.

Tibiae with ventral carina (but particularly of the median pair) microscopically denticulate becoming hirsute more and more decidedly distad.

*Allotype.*— ♀ ; same data as type. [Hebard Collection].

Agrees closely with this sex of typical *velii velii* except in the larger size, much shorter cerci and brief blackish suffusions of the femoral apices. More robust than male (and averaging larger), but with femora proportionately shorter, much simpler and disto-external ventral tooth of median and caudal pair much smaller and less conspicuous. Head longer than pronotum, its length greater than its width at (and including) the eyes, which latter are very slightly less prominent than in the male. Seventh tergite simple, intermediate in length between the simple eighth and ninth tergites. Cercus small, simple, cylindrical, tapering to its rounded apex, projecting beyond the supra-anal plate slightly more than twice its width there. Operculum reaching to apex of eighth tergite, its distal margin obtuse-angulate produced mesad. Cephalic femur much shorter than in male, approximately equal to combined length of mesonotum and one-half that of pronotum, proximad more curved and beyond more lamellate. Median femur only slightly thickened and with ventro-external subapical tooth much smaller than in male. Caudal femur not thickened and with homologous tooth very small and inconspicuous.

*Coloration.*—Male generally brownish buff, the head with a faint suffused postocular line. Cephalic femora and median tibiae light green to near apices and a few antennal joints beyond the first tinged with green. Spines of median and caudal femora blackish brown.

Female generally brownish buff, the suffused postocular line more conspicuous, greenish becoming light green and broader on pronotum, mesonotum, metanotum, median segment and first abdominal tergite, the other tergites entirely this color. A buffy line which separates the dorsal from the ventral segments becomes weak caudad. Limbs brownish buff, cephalic femora strongly and median femora feebly green'proximad, all femora with apices briefly but conspicuously blackish brown.

This sex also develops a very dark gray or strongly grizzled light and dark gray color phase in which the dark apical areas of the femora are naturally less conspicuous.

Large immature females show no trace of the apical femoral coloration, so I feel that this is the least important of the apparently striking features which distinguish the race. Conversely the lipping of the male poculum is important, being indicated down to quite small instars of immaturity.

It is probable that the normal color phase is usual in individuals living in mesquite, weeds and grasses, which are certainly the types of environment in which this walking-stick occurs in greatest numbers, while the very much scarcer gray phases probably live in the gray leafless desert brush of the region.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of mesonotum | Median width of mesonotum | Length of metanotum (including median segment) | Length of median segment | Length of caudal femur | Dorsal length of seventh tergite |
|---|---|---|---|---|---|---|---|
| Corpus Christi, Tex. | 70. | 14.9 | 1.7 | 14.4 | 2.1 | 17.7 | 1.9 |
| Benavides, Tex. (16) ...... | 59.8-80.3 | 13.8-17.8 | 1.6-1.9 | 12.9-16.8 | 1.8-2.4 | 18.8-23.2 | 1.7-2.3 |
| Marathon, Tex. (22) ...... | 65. -88.2 | 14.7-20.2 | 1.4-2. | 13.7-19.8 | 1.9-2.6 | 19.7-24.8 | 1.8-2.4 |
| ♀ | | | | | | | Cercus exceeds supra-anal plate by — |
| Benavides, Tex. (4) ....... | 72.7-85. | 15.8-19. | 3.1-3.2 | 12.9-15.3 | 2. -2.1 | 16.8-19.3 | 1. -1.4 |
| Marathon, Tex. (19) ...... | 77.8-93.8 | 15.9-19.9 | 3.2-3.4 | 15.9-17.4 | 2.1-2.8 | 17.3-19.7 | 1.1-1.8 |
| Denton Well, New Mexico ... | 81.3 | 17.3 | 3. | 14.8 | 2.3 | 17.8 | 1.1 |

Males of *D. tamaulipensis* Rehn are superficially very similar but may be readily separated by the very different poculum. They also appear definitely more slender, but rare males of *velii eucnemis* are much more slender than is usual in this race.

Series before me of atypic *velii velii* which differ from that race and converge toward *velii eucnemis* in averaging fully as large as the latter, with female femora black tipped, are from Ballinger, Big Spring, Metz, Barstow and Pecos, Texas. Such a tendency, but in color only and that weaker, is shown by material from the malpais near Carrizozo and the White Sands in the Tularosa Valley, New Mexico. Down the Rio Grande, however, *velii velii* has apparently extended its distribution far southward, females before me from El Paso, Texas, being apparently typical of that race.

*Specimens examined:* **117; 56 males, 31 females and 30 immature individuals.**

**Texas: Corpus Christi, VII, 29, 1912, (M. Hebard; in plants and grasses near beach), 1♂, 1♀ (female dark gray, atypic in having longer cerci,**

which extend beyond supra-anal plate 2.2 mm.). Robstown, VIII, 9, 1912, (M. Hebard; immatures common on Mesquite), 1 medium juv. ♂, 2 medium juv. ♀, (pair light green, one female mottled dark gray). Lyford, VIII, 6 and 7, 1912, (Rehn and Hebard; in low weed in field), 1♀. Jim Wells County, VII, 24, 1928, (R. H. Beamer), 1♂. Brooks County, VII, 25, 1928, (R. H. Beamer), 1♂, [Univ. of Kansas]. Brownsville, VI, (C. F. Wickham), 1♂, [A.N.S.P.]. Benavides, VIII, 9 and 10, 1912, (Rehn and Hebard; on Mesquite), 16♂, 4♀, small to medium juv. ♂, 1 medium juv. ♀. Cotulla, V, 11, 1906, (F. C. Pratt), 1♂, [U.S.N.M.]. Laredo, VIII, to 10 12, 1912, (Rehn and Hebard), 3♂, 2 small and medium juv. ♂, 1 medium juv. ♀. Uvalde, VI, 18 to 20, (C. F. Wickham), 1♂, 1♀; VIII, 21 and 22, 1912, (Rehn and Hebard; on hill slopes on low sensitive-leaved mimosa), 1♂, 1♀, 3 small juv. ♂. Carrizo Springs, X, 1 to 10, 1884, 1♂, 1♀. Del Rio, VIII, 22 and 23, 1912, (Rehn and Hebard), 3 small juv. ♂. Marathon, VIII, 20, 1919, (J. A. G. Rehn), 3♂, *paratypes*, 1 medium juv. ♂; 3900 feet, IX, 12 and 13, 1912, (Rehn and Hebard; very local but very common in high grasses in damp spot on plain), 22♂, 19♀, *type, allotype, paratypes*, 1 large juv. ♂, 2 medium large juv. ♀ (one female uniform gray, two immature females mottled gray). Hackberry Creek, IX, 2, 1912, (Rehn and Hebard), 1 large juv. ♂. Garden Spring, IX, 2 and 11, 1912, (Rehn and Hebard), 1 large juv. ♂. Two miles north of Bone Spring, IX, 9, 1912, (Rehn and Hebard), 1♀, 1 large juv. ♀ (the latter mottled gray). Neville Spring, IX, 5 and 8, 1912, (Rehn and Hebard), 1 medium juv. ♀ (mottled gray). Chisos Mountains, VII, 1911, (H. A. Wenzel), 1♂, [A.N.S.P.]. Western foothills of Ord Mountains, 1928, (O. C. Poling), 1♂, 1♀ (female dark gray). Sierra Blanca, 4700 feet, IX, 14, 1912, (M. Hebard; in green yellow-flowered bush), 1♂.

New Mexico: Lake Valley, (from Cope Collection), 1♀ (dark gray), [A.N.S.P.]. Deming, 4300 feet, VII, 18, 1907, (Rehn and Hebard), 1 medium juv. ♂, 5 medium to small juv. ♀ (largest female gray). Denton Well in Playa Valley, 4200 feet, IX, 27, 1922, (M. Hebard; in Mesquite), 1♀.

## VIII. ON A NEW SPECIES AND A NEW RACE OF THE ACRIDINAE, (ACRIDIDAE)

**Opeia atascosa** new species (Pl. XXII, figs. 3 and 4.)

Recent investigation of very large series indicates that *Opeia obscura* (Thomas) is the only widespread species of the genus in the United States[8] and though it manifests some geographic differentiation, of the previously described species from this country only *imperfecta* Bruner can probably be given even racial recognition.

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[8] It is unfortunate that both Scudder and Bruner, misled by color phases and variation in degree of development of the organs of flight, proposed so many names which must be considered synonyms in the genus *Opeia*. In 1932 I placed under *mexicana* Bruner, that author's *palmeri*, and his *lineata*, described from the same locality as the latter, is apparently nothing but the more contrastingly colored condition of the same insect.

From typical *obscura* the present species is strikingly distinguished by the longer antennae, the lesser contrast between the length of the caudal tibial spurs, the faint though definite dorsal convexity, comparatively large size and more elongate head, eye and pronotum.

*Type.*—♂; southwest slopes of Atascosa Peak above Bear Valley, Pajarito Mountains, Arizona. Elevation 6500 feet. September 21, 1922. (M. Hebard). [Hebard Collection, Type no. 1312].

Size large and form slender for genus. General appearance more cylindrical than in *obscura*. Head elongate. Lateral foveolae not visible from above, decided, long and very narrow. Antennae elongate and moderately ensiform. Eye elongate, strongly oblique, decidedly longer and also more sharply rounded at dorsal apex than in typical *obscura*. Fastigium subrectangulate produced and very bluntly rounded, nothing of frontal costa visible from above (a small section of that area visible from above in typical *obscura*), strongly impressed just inside margins, then with surface feebly convex to the very weak (individually varying to obsolete) medio-longitudinal carina. Face strongly retreating, frontal costa decidedly sulcate, a fine parallel carina just before eye and a fine sub-ocular sulcus present. Pronotum elongate, disk with medio-longitudinal and lateral carinae moderately decided, parallel and percurrent, its caudal margin very feebly obtuse-angulate produced. Organs of flight considerably reduced, distinctly longer than combined length of head and pronotum, longitudinal veins distinct and regular. Tegmina transversely gently convex with surfaces of the rounded apices convex so that the margins only meet (in typical *obscura* the tegmina normally show definite flattening of the dorsal and lateral fields with distal portion much more approximate, almost vertical and exhibiting little or no apical curvature of their surfaces, but in some material of that insect as described for *atascosa*, this possibly accompanying greater than usual wing atrophy), marginal fields moderately fenestrate, costal margin with meso-proximal convexity broad but definite. Wings considerably atrophied, extending only half the distance to the apices of the tegmina (in *obscura* normally no more reduced than the tegmina, but varying to an extreme condition similar to that normal for *atascosa*). Subgenital plate rounded to the sharply rounded (or minutely binodose) apex. Caudal femora moderately stout, expansion proximad very gradual; dorsal genicular portions not produced, ventral lobes rounded. Internal spurs of caudal tibiae unequal, the ventral averaging less elongate than in *obscura*, the inequality being less than in that species.

*Allotype.*—♀; same data as type. [Hebard Collection].

Much larger but otherwise very similar to male except as follows. Antennae proportionately shorter, slightly more strongly ensiform. Pronotum with caudal margin of disk even more weakly produced, very broadly rounded obtuse-angulate. Tegmina more sharply rounded at their apices. Ovipositor jaws very short, curved at their heavy apices.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of antenna | Length of pronotum | Caudal wid of pronotal disk | Length of tegmen | Length of caudal fem |
|---|---|---|---|---|---|---|
| Southwest of Atascosa Peak .... | 18.7-20.2 | 9.3-10.7 | 3.8-4.3 | 2.1-2.4 | 8.7- 9.9 | 10.7-12. |
| North of Montana Peak .... | 18.5-19.4 | 9.9-10.1 | 3.8-4 | 2.1-2.2 | 8.7- 8.7 | 9.9-11. |
| | | | | | | |
| Southwest of Atascosa Peak .... | 27.7-29.8 | 9.1-10.2 | 5.8-6.2 | 3.2-3.3 | 10.3-10.3 | 14.6-14.8 |
| North of Montana Peak .... | 24.7-25.8 | 7.8- 9.1 | 5.1-5.4 | 2.8-3.1 | 8.3- 9.2 | 13. -13. |

For comparative purposes the measurements on the largest pair of *obscura,* from Marathon, Texas, are here given. Length of body ♂ 17.3, ♀ 25.1; length of antenna ♂ 8.8, ♀ 8.7; length of pronotum ♂ 3.4, ♀ 5.1; caudal width of pronotal disk ♂ 2., ♀ 3.1; length of tegmen ♂ 8.3, ♀ 11.6; length of caudal femur ♂ 11., ♀ 15.5 mm. These specimens are decidedly larger than any of *obscura* from the Great Plains.

*Coloration.*—Generally light brownish buff, often with a broad postocular blackish band continued across the pronotum and sometimes on the tegmina where it gradually disappears, but in females it is often represented only by a narrow dorso-lateral streak. In some specimens this band is paler in color and broader, leaving scarcely the ventral quarter (instead of distinctly over the ventral half) of the pronotal lateral lobes pale. Antennae, cephalic and median tibiae and caudal tibiae ventro-distad suffused with brown. Lateral foveolae, face and eyes usually brown. Caudal femora sometimes with a suffusion of dark brown along dorsal portion of external pagina.

Though agreeing in so many features with *obscura,* the present species has a smoother, more convex and graceful appearance which is distinctive.

In 1922 I found this insect in bunches of fine grass (*Elyonurus barbiculmis* Hackel) on very steep mountain slopes dotted with oaks, in company with *Prorocorypha snowi* Rehn, but decidedly more numerous than that remarkable species and distributed over slightly wider areas. Apparently also only present in this grass were immatures of *Achurum sumichrasti* (Saussure) and *Amblytropidia mysteca* Saussure. My notes state " Elsewhere at the same elevation in richer grasses this species nowhere occurred. The males, though having exceedingly great saltatorial powers, were by no means wary and could be easily captured ". In 1924 I again found the species, and again the three other undoubtedly Mexican forms, a few miles to the west at a lower elevation in the same grass, very local and scarce on the topmost part of a hill, with some oaks and a few piñon in the vicinity.

A number of other interesting Mexican species occur in this interesting region, whence *Perixerus gloriosus* Hebard, a member of a Mexican genus, and the present species only are known. It is evident that conditions in these mountains, just west of Nogales, are such that more traces of a Mexican flora and fauna may there be present than in any other area on the Mexican border, the Huachuca Mountains alone representing a region which in this respect I believe further investigation may prove to be as rich or richer.

*Specimens examined:* 19; 14 males and 5 females.

ARIZONA: Southwest slopes of Atascosa Peak above Bear Valley, Pajarito Mountains, 6500 feet, IX, 21, 1922, (M. Hebard), 12♂, 3♀, *type, allotype, paratypes* (seven males, three females contrastingly colored). Hilltop north of Montana Peak, Pajarito Mountains, 5000 feet, IX, 21, 1924, (M. Hebard), 2♂, 2♀.

**Amphitormus coloradus saltator** new subspecies (Pl. XXIII, fig. 1)

This insect is very close indeed to *coloradus ornatus* McNeill,[9] differing only in the average small size and striking reduction of the organs of flight. The former feature is known to have, in itself, practically no diagnostic significance. Appearance over often considerable areas of a brachypterous condition, which in the same species never appears elsewhere, would seem best recognized as a race. Occasional brachypterous individuals in a macropterous species, or vice versa, plainly do not merit nominal recognition of any kind. Other races which have been recognized on much the same grounds as the present race are: *Horesidotes cinereus saltator* Hebard,[10] *Ageneotettix deorum curtipennis* Bruner[11] and *Melanoplus occidentalis brevipennis* Bruner.[12] There are also a greater number of races showing constant brachypterism accompanied by other features which are clearly the response to more boreal environment or higher altitudes than normal for their species and which are limited to and often isolated by such conditions. Even more complex may prove to be what I have felt best recognized as western races of *Campylantha olivacea* (Scudder) and the Great Basin races of *Aeoloplus, Oedaleonotus* and *Hesperotettix,* where thorough revisionary treatment is still badly needed.[13]

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[9] I suggested that *ornatus* McNeill might represent a race of *coloradus* (Thomas) in 1935 (Trans. Amer. Ent. Soc., LXI, p. 280). Having now completed the geographic sorting of our entire series of the genus, it becomes evident that two weakly distinguishable races of one species are represented by those names, though both these races are subject to considerable individual variation.

*Type.*—♂; east of pass on road from Ely to Osceola, Shell Creek Range, White Pine County, Nevada. Elevation 8100 feet. August 29 and 31, 1924. (Rehn and Hebard). [Hebard Collection, type no. 1313].

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[10] Described Trans. Amer. Ent. Soc., LVII, p. 116, pl. 22, fig. 2, (1931). Found in extreme southern coastal California and probably through coastal Baja California, as it occurs atypic in southern Baja California.

[11] See Hebard, Trans. Amer. Ent. Soc., LXI, p. 284, pl. 4, figs. 12 to 14, (1935). From our material found to occur from Fort Wingate, New Mexico to Ash Fork and Prescott, Arizona, but atypic to central western and southern Colorado and central New Mexico and also, though there isolated, in the Huachuca Mountains of southeastern Arizona.

[12] See Hebard, Proc. Acad. Nat. Sci. Phila., LXXXI, p. 386 (1929). Typical only in central western Colorado. A tendency toward it shown in the Sierra La Salle in central eastern Utah and in the Chilcotin District of British Columbia.

[13] Much progress has however been made since the time when color phases, adaptations to conditions of immediate environment and races were frequently described as new species from the then little known West.

Agrees closely with *coloradus ornatus* except in being unusually small for that race,[14] the organs of flight are decidedly reduced, however, being shorter than the caudal femur, thus leaving the distal portion of the abdomen exposed.

*Allotype.*—♀; same data as type. [Hebard Collection].

Generally very similar to male but considerably larger and more robust, with vertex blunter, as is always the case in this sex of the present species. The organs of flight are reduced in approximately the same ratio, but appear even shorter as a much greater distal portion of the decidedly longer abdomen remains exposed. Compared with females typical of *coloradus ornatus* this female is unusually small and slender.[15]

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Caudal width pronotal disk | Length of tegmen | th of al femur |
|---|---|---|---|---|---|
| ♂ | | | | | |
| Beaver Canyon, Utah, 7100 feet .......... | 15.8-16. | 2.9-2.9 | 1.8-1.9 | 6.6- 7.2 | 9.2- 9.4 |
| Beaver Canyon, Utah, 6600 to 6700 feet ......... | 15.8 | 2.8 | 1.8 | 6.4 | 9.4 |
| Beaver, Utah, (atypic) ...... | 16.7 | 3. | 2. | 7.8 | 9.3 |
| Pass in Shell Creek Range, Nev., 8100 feet .... | 13. -14.2 | 2.5-2.6 | 1.7-1.7 | 7.1- 7.2 | 7.6- 8.7 |
| Kaibab Plateau, Ariz., 6700 feet, (atypic) ....... | 14.8 | 2.8 | 1.8 | 8.1 | 8.8 |
| ♀ | | | | | |
| Beaver Canyon, Utah, 7100 feet .......... | 20.2 | 3.7 | 2.1 | 7.2 | 10.2 |
| Beaver Canyon, Utah, 6600 to 6700 feet ......... | 20.1-20.4 | 3.7-3.8 | 2.2-2.3 | 6.8- 8.1 | 10.3-11.7 |
| Beaver, Utah, (atypic) ...... | 20.8 | 4.2 | 2.3 | 8.9 | 11.7 |
| Pass in Shell Creek Range, Nev., 8100 feet .... | 18.3-19.4 | 3.1-3.5 | 2. -2.1 | 6.8- 8.3 | 9.1- 9.8 |
| Kaibab Plateau, Ariz., 6700 feet, (atypic) ....... | 18.9-19.1 | 3.8-3.9 | 2.1-2.2 | 9.9-10.7 | 10.7-10.8 |

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[14] The exceptionally depauperate male described as *nanus* (a synonym of *coloradus ornatus*) by Rehn and Hebard from the south face of the Grand Canyon, on the Bright Angel Trail, Arizona, is as small as the present type, but the average in the paratypes of *coloradus saltator* is even slightly smaller. Nearest approach to these in size is found in my series of *coloradus ornatus* from Phoenix, Arizona.

[15] The paratypic females agree closely, particularly in the degree of reduction of the organs of flight.

*Comments.*—Were it not for the uniformity shown in the reduction in the organs of flight in several widely separated areas, indicating stability in this feature in similar environment over a considerable extent of territory, I would not consider recognizing the present condition as a race. In the valleys and generally at lower elevation over the region where *coloradus saltator* is found no material of the species has been taken. If the species exists there it will be of interest to discover which race is represented. From the Beaver specimens, however, even closer approach to *coloradus ornatus* is suggested for individuals from still lower elevations.

The type series appears quite uniform, the majority of the specimens being about intermediate between the extremes.

*Coloration.*—The color and color pattern is characteristic of the species. From the type locality two males and two females have a uniform dark pronotal disk and lack supplementary carinae as is usual in that color phase, but one female with a striking pale medio-longitudinal band has the supplementary carinae subobsolete.

*Specimens examined:* 42; 16 males and 26 females.

UTAH: Summit of upper bench of Beaver Canyon, Tushar Range, 7100 feet, VIII, 22, 1926, (Rehn and Hebard; scarce in grasses in sage brush at highest point that the Rocky Mountain Yellow Pine grows), 3♂, 1♀. Beaver Canyon, Tushar Range, 6600 to 6700 feet, VIII, 20, 1926, (Rehn and Hebard; very scarce in short grass and also on composite and sage brush covered hillside), 1♂, 1♀. Beaver, VII, 4, 1924, (W. W. Henderson), 1♂, 1♀, [A.N.S.P.].

NEVADA: East of pass on road from Ely to Osceola, Shell Creek Range, White Pine County, 8100 feet, VIII, 29 and 31, 1924, (Rehn and Hebard; in fine dry yellow grass where this was thickest in the draws; occasional, the series secured only after long continued specialized effort), 10♂, 17♀, *type, allotype* and *paratypes*. West of same pass, 7900 feet, VIII, 28, 1924, (M. Hebard; very scarce in tufts of fine yellow grass on mountain slopes in opening of juniper area with some piñon), 2♀, *paratypes.*

ARIZONA: Northwest slope of Kaibab Plateau, 6700 feet, IX, 3, 1926, (Rehn and Hebard; very scarce near composites among juniper and piñon), 1♂, 2♀. San Francisco Mountains, IX, 8, 1932, (E. D. Ball), 1♀ (atypic, others of this series represent *coloradus ornatus* or are slightly atypic of that race in showing weak reduction of the organs of flight.

Other material showing weak reduction in the organs of flight I consider representative of slightly atypic *coloradus ornatus* from the following localities: Cedar Creek and Carbon Junction (one female, others in series being virtually typical), Colorado; Chama, New Mexico (very slightly atypic); Egan Range at 8000 feet near Ely, Nevada; the San Francisco Mountains, Arizona (part of the series), and the merest trace of such is indicated in some series from the Northwest.

In summarizing I would state that *coloradus saltator* is a development of the western race *coloradus ornatus* occurring typical only over an area lying in the southeastern portion of the Basin and Range Province, there present only at the higher elevations at which the species can exist. In this region (south and west of the Wasatch Mountains in Utah west to the Shell Creek Range in Nevada) even in the least sterile lower areas the species has not been found. From the Wasatch Mountains in Utah, southern Idaho, Nevada south and west of the Egan Range to Crestline, only *coloradus ornatus* is present both in the mountains and the valleys.

## IX. ON ARPHIA CONSPERSA, NOTES AND A NEW SPECIES OF SPHARAGEMON, A NEW GENUS AND ITS RACES OF THE GROUP HELIASTI AND A NEW GENERIC NAME FOR THE GROUP ANCONIAE, (OEDIPODINAE, ACRIDIDAE)

### The phases of *Arphia conspersa* Scudder

I have recently studied our entire series, numbering many hundred specimens, of this remarkably variable species and feel that a brief summary of the data will be of use to students perplexed by the various individuals they may encounter which often superficially appear to represent quite distinct species or at least races.

There are five phases which have a geographic correlation. Each, however, is not only subject to decided individual variation but also shows such striking response to conditions of immediate environment that its extremes are often quite as widely different as any of the typical representatives of the other phases. Moreover, in some cases, one phase fades into another gradually over a wide extent of territory. For these reasons, though it long seemed possible that some valid races existed, I do not feel justified in recognizing any geographic races whatever in the case of *conspersa*.

The phases may be summarized as follows:

1. Size average small, form moderately robust and coloration dark for the species. Wing disk yellow (apparently always so in Alaska), orange or pink. Caudal tibiae buffy with two (often very broad) dark suffusions (which range from subobsolete to wholly fusing). Alaska and far North south to northern Great Plains and northwestern Prairies.

2. Size average large, form very robust and coloration pale for the species. Wing disk usually rich orange or rich pink. Typical in northeastern and northcentral Texas and adjacent Oklahoma, gradually changing to the first phase in Nebraska.

3. Much like the first phase, the vertex averaging narrower, though that area is subject to very decided individual variation in both of these phases. Mountains of southern Colorado and northern New Mexico.[16]

4. Vertex as in third phase, size average large but form quite graceful for the species. Wing disk usually rich bittersweet orange. Caudal tibiae with paler portions sometimes definitely glaucous in southeastern portions of Great Basin. Wasatch Mountains and higher valleys in Utah to mountainous regions of northeastern Arizona.

5. Vertex averaging even narrower than in third phase. Size average small to very small, form graceful (but occasionally females appear robust), coloration often dark but sometimes pale for the species. Wing disk yellow or orange. Caudal tibiae in many of the larger series (but not in some series from the region) with paler portions light to rich glaucous. Plateaus and mountains of northwestern Arizona.

The synonymy as it applies to the above phases is:

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[16] In these regions of very diverse contour the size usually decreases with increase in elevation.

(Phase 1) *frigida* Scudder 1875, type locality here selected, Yukon River, Alaska; *arcta* Scudder 1876, type locality Denver, Colorado.

(Phase 2) *conspersa* Scudder 1875, type locality Dallas, Texas; *infernalis* Saussure 1884, type locality Texas.

(Phase 3) *teporata* Scudder 1875, type locality selected by Hebard 1927, southern Colorado.

(Phase 4) *canora* Rehn, type locality selected by Rehn and Hebard 1912, Salt Lake City, Utah.

### The Genus **SPHARAGEMON** Scudder

This genus was described by Scudder in 1875, who selected as genotype *Oedipoda equalis* Say. It was revised by Morse in 1895. Much confusion in nomenclature has occurred, seven species and one geographic race being now recognized as valid. Some of these break into a multiplicity of chromatomorphs and in some, other differences (such as of size and form) are frequently encountered, while geographic differences in a few, though appearing decided, are in all cases a gradual change from small to large and more ample development southward, unworthy of racial recognition.

Though *inornatum* may prove to be nothing more than the response in *bolli* to the greatest aridity that species can endure, it appears best to give it racial recognition as it shows definite stability over a considerable area.

One species, *Spharagemon humile* Morse 1895, as I stated in 1929, must be removed from the genus. It is nearest the species related to *Trimerotropis pistrinaria* Saussure and must therefore be referred to that genus as at present understood, though widely different from the genotype *Trimerotropis maritima* (Harris). Its superficial resemblance to certain of the color phases of *Spharagemon equale* (Say) and *Trimerotropis campestris* McNeill is very great.

Only in occasional individuals of *equale* (Say) and rarely in *planum* Morse does the cephalic portion of the pronotal crest show an appreciable impression of its dorsal margin. In such cases great care must be taken not to be misled into thinking that a specimen of *Trimerotropis* is represented. Usually such an impression is definitely broader and shallower than is ever the case in that genus, but rare individuals of *equale* are very easily mistaken for examples of *T. campestris* or *humile.*

The coloration of the caudal tibiae is distinctive in many of the forms of the genus and can be summarized as follows.

1. Never definitely annulate proximad, but sometimes washed there with buffy externally, this very rarely extending to all sides............2
   Definitely annulate proximad......................................3
2. Rich (rarely) to pallid orange; light yellow only in series from British Columbia...............................................*equale* (Say)
   Rich pink.........................................*collare* (Scudder)
3. (Clear translucent scarlet), proximal pale annulus short and without trace of succeeding suffusion..................*superbum* new species
   Proximal pale annulus broad, succeeded by a trace of dark suffusion to an extensive dark annulus.........................................4
4. Less than proximal third buffy slightly suffused with brown, over median third dark brown, over distal third light brown or suffused weak pink. *crepitans* Saussure
   Rich pink.........................................................5
5. A subobsolete to distinct suffusion succeeding proximal annulus.
   *bolli inornatum* Morse
   *planum* Morse
   *saxatile* Morse
   A heavy extensive dark brown annulus succeeding proximal annulus, which varies from moderate (rarely) to very decided (usual).
   *bolli bolli* Scudder

The species may be arranged in the following sequence, dividing naturally into three definite groups with *planum* and *saxatile* plainly transitional between the first and second in structure but definitely closer in relationship to each other.

### *Equale* Group

**Spharagemon equale,** (Say) 1825

Often improperly emended to *aequale.*

*Dissosteira texensis* Saussure 1884, synonymized by Caudell in 1911.

At that time Caudell incorrectly assigned *Oedipoda belfragii* Stål to synonymy here, that name being a synonym of *collare.*

### *Saxatile* Group

**Spharagemon planum** Morse 1904

Originally described as a race of *saxatile* Morse. Series of these insects now before me, including paratypes of each, show constant differences and no tendency toward intergradation either toward the northern limits of *planum* or the southern limits of *saxatile*, which are adjacent. They do, however, occupy identical positions in the fauna of their respective areas of distribution.

**Spharagemon saxatile** Morse 1894

Prior to its description this species had been confused with *Oedipoda equalis* and *S. bolli*.

### *Bolli* Group

**Spharagemon bolli inornatum** Morse 1895

The differences from *bolli* are insufficient to warrant specific recognition and intergradation in these is also shown by material before me from the interval between the area of distribution of typical *bolli* and the present race.

**Spharagemon bolli bolli** Scudder 1875

*S. balteatum* Scudder 1875, placed as a variety by Saussure 1884, synonymized by Morse 1894.

Morse in 1895 described *S. robustum,* questioning it as possibly only an extremely large form of *bolli.* The type is a female labelled " Coahuila " and apparently represents nothing more than the optimum condition of *bolli.* Additional Mexican material is needed to determine its status with finality.

**Spharagemon crepitans** (Saussure) 1884

Described as a variety of *Dissosteira bolli* this insect was doubtfully given specific status by Morse in 1895 and definitely so placed by Kirby 1910. The acquisition of sufficient series enabled Rehn and Hebard to substantiate that decision in 1916.[17]

**Spharagemon collare** (Scudder) 1871

*Oedipoda wyomingiana* Thomas 1872, frequently considered a race of *collare,* synonymized by Kirby 1910.

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[17] Proc. Acad. Nat. Sci. Phila., 1916, p. 184, pl. 12, figs. 9 and 10.

*Oedipoda belfragii* Stål 1873, synonymized by Hebard 1929.

*S. cristatum* Scudder 1875, racial status suggested by Hubbell 1926, so placed by Hebard 1932, synonymized in the present paper.

*S. aequale scudderi* Morse 1894, transferred by him to *collare* in 1897, synonymized by Kirby 1910.

*S. oculatum* Morse 1895, synonymized under *wyomingianum* by Blatchley 1903, synonymized by Kirby 1910.

*S. collare angustipenne* Morse 1895, synonymized by Kirby 1910.[18]

**Spharagemon superbum** new species (Pl. XXI, figs. 2 and 3.)

This exceedingly distinctive insect is nearest *S. collare* (Scudder), agreeing more closely with the optimum of that species in structure than would be expected in an insect so widely different in all features of coloration and color pattern.

These two species belong to that section of the genus in which the pronotum has a high percurrent crest with the dorsal margins of both sections convex, the metazona strongly produced caudad with lateral margins there broadly concave convergent to an acute apex.

The following generic characters are shown by the males of the present species. Lateral foveolae short, triangular. Pronotum with medio-longitudinal carina or crest intersected by a single cleft. Interspace between mesosternal lobes definitely transverse. Tegmina of moderate width, intercalary vein flexuous, transition from opaque two-thirds to transparent distal third not sharp. Wings with a prominent band and disk colored.

*Type.*— ♂ ; Katherine, Willacy County, Texas. August 8, 1912. (M. Hebard). [Hebard Collection, Type no. 1315].

Very similar in general structure to the optimum of *collare* (numerous in the same environment at Katherine). Size medium large, form graceful and slightly less robust than such material of that species. Vertex pear-shaped, its surface moderately concave, with a very delicate feeble medio-longitudinal carina, joining the moderately concave surface of the frontal costa without interruption, lateral carinae of both these areas fine and sharp. Frontal costa moderately broad (showing weak expansion just above median ocellus only in paratype). Eye not large, moderately prominent. Pronotum strongly cristate throughout, the crest on prozona increasing in height with dorsal margin broadly convex to the very deep cleft, its sides there pinched cephalad, somewhat swollen toward base caudad, that area with a few feeble tubercles, the crest on metazona with dorsal margin broadly convex and its sides pinched throughout, surface very faintly tuberculate and generally appearing almost smooth; lateral carinae defined by irregular tubercles and cut by all three sulci; lateral lobes decidedly deeper than wide, their ventro-caudal angles extending ventrad and very broadly rounded, surface appearing smooth but with sulci decided. Organs of flight fully developed, but more produced than is usual in *collare*. Tegmina proportionately slightly narrower with veinlets more numerous and regular. Wings with apical portion also slightly narrower. Limbs much as in that species and similarly hirsute, but caudal femora even more decidedly lamellate both dorsad and ventrad than in its optimum. Genitalia similar. Coloration and color pattern very important.

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[18] Though Kirby did not recognize races, those described for *collare* by Morse are all local environmental adaptations or individual variants unworthy of nominal recognition of any kind.

*Coloration.*—Appearance very different from that of any known American grasshopper, having an exceptionally rich softness, the even blending of the tegminal colors giving a somewhat metallic effect and the banding and tessellation characteristic of all the other species of *Spharagemon* being wholly lacking. Head dresden brown, darker above eyes and paling on cheeks to buffy, with a pair of buffy spots on occiput and a fleck of the same in and before the foveolae, a weak narrow transverse suffusion of ochraceous-tawny across base of vertex. Pronotum dresden brown with a large triangular area of buffy at caudal summit of prozonal cristation, disk in limited flattened areas also pale (this continued to include the caudal portions of the lateral lobes in the paratype). Tegmina ferruginous in proximal portion except for a broad area of buckthorn brown including and on both sides of the humeral vein which broadens at end of intercalated field, the remaining portions of the tegmina transparent, tinged with brown with veins and veinlets dresden brown. Wing disk dull antimony yellow, followed by an exceedingly broad dark brown wing band (actually solidly prouts brown but appearing darker) which very gradually weakens on both sides, its portion bounding the radiate field with intervals between the veins and transverse veinlets including transparent areas faintly tinged with brown, the apex of the wing with veins and veinlets strongly and evenly prouts brown. Sides of body prouts brown, a lateral fleck of buffy dorso-caudad on the visible tergites, ventral surface pale dresden brown. Cephalic and median limbs mummy brown, the femora all with a trace of a premedian buffy annulus. Caudal femora mummy brown, with two very broad vertical external irregular bands of buffy, the first only crossing the external pagina, the second suffused on the external pagina but percurrent; internal surface blackish crossed by the same bands which there are very pale, but ventral surface crossed only by the second. Caudal tibiae and tarsi clear translucent scarlet, a short post-proximal whitish buff annulus present with short proximal area preceding tinged with brown externally.

*Measurements.*—Length of body 27. and 26.3; length of pronotum 7.4 and 7.6; greatest vertical height of pronotal crest 2.6 and 2.8; caudal width of pronotal disk 4.6 and 4.4; length of tegmen 28.9 and 27.3, greatest tegminal width 5.1 and 5.; length of caudal femur 15.5 and 15.8; greatest width of caudal femur 4.8 and 4.7 mm.

I was greatly surprised when the first male flew a short distance out of a thick growth of low oak shoots near extensive oak thickets in the loose sand region near Katherine. Its dark coloration was in great contrast to this environment bathed in brilliant sunlight. Its flight was weak and fluttering, but long continued search there, where *Phaedrotettix accola* (Scudder) was abundantly present, resulted only in the discovery of the single paratypic male here discussed.

## THE GROUP HELIASTI

I refer to this group the genera *Heliastus* Saussure 1884,[19] with genotype *Oedipoda* (*Sphingonotus*) *sumichrasti* Saussure 1861,[20] and *Cibolacris* here described.

### CIBOLACRIS new genus

This genus is proposed to include *Oedipoda parviceps* F. Walker 1870, *Thrincus ? aridus* Bruner 1889 (which I had believed to be a synonym but place here as a race of that species) and *Thrincus californicus* Thomas 1874 (here reduced to a race of *parviceps*).[21] During recent years these names have all been referred to the genus *Heliastus*.

GENOTYPE: *Oedipoda parviceps* F. Walker.

The genus may be distinguished from *Heliastus* by the following characters. General contour of head suggesting the Anconiae instead of the Trimerotropi, vertex with fine lateral carinae suddenly strongly convergent distad and briefly separated at apex of the fastigium. Antennae very short. Eyes more prominent. Pronotum weakly sellate; definitely constricted in cephalic portion (but not as decidedly so as in *Anconia*); cephalic margin of disk with two (usually definite) small adjacent median convexities; caudal production of disk with apex broadly rounded. Caudal femora short and robust, with carina ventrad on internal face closely toothed. No trace of wing band ever shown.

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[19] Material of *Heliastus* is before me which has been referred to the following species: *benjamini* Caudell, *aztecus* Saussure, *venezuelae* Saussure, *guatemalae* Saussure, *sumichrasti* (Saussure) and *subroseus* Caudell. The latter was described as a variety of *sumichrasti*, but I find it to be a distinctive species peculiar to the sandy strand areas of the Gulf Coast.

[20] Selected by Rehn in 1904.

[21] See Hebard, Trans. Amer. Ent. Soc., LVII, p. 120, (1931) for synonymy and discussion.

Agreement with *Heliastus* is shown by the following characters. Form moderately robust. Pronotum without lateral carinae, disk rounding evenly into lateral lobes except in the metazonal portion where there are rounded shoulders; median carina obsolete or very feebly indicated. Tegmina lacking an intercalary vein. Caudal tibiae with disto-internal spurs moderately elongate, equal.

Unlike the genotype, but agreeing with some of the other species of *Heliastus* in these features, *Cibolacris* has the ventro-caudal angle of the pronotal lateral lobes very broadly rounded and not at all produced and the internal portion of the dorsal surface of the caudal femora is strongly hirsute.

**Cibolacris parviceps arida** (Bruner) (Pl. XXII, fig. 5; pl. XXIII, fig. 2.)

1889. *Thrincus* (?) *aridus* Bruner, Proc. U. S. Nat. Mus., XII, p. 78, pl. 1, figs. 2 and 3. [♂, ♀; Albuquerque, New Mexico.]

In 1931 Uvarov kindly compared the type of *Cibolacris parviceps parviceps* (F. Walker) with a number of specimens of the species from different parts of its range which I sent him for this purpose. It is a female (not a male as originally stated) from the "West Coast of America" and agrees very closely with a female in my collection from San Bartolo, Baja California.[22] I noted then that such a condition "averaging much smaller with fastigium averaging narrower" occurred at the southern extremity of the peninsula of Baja California, but so great was the variation in other portions of the region that I decided such differentiation insufficient to warrant even racial recognition and consequently synonymized Bruner's *aridus*.

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[22] A previously unrecorded series of *parviceps parviceps* from San José del Cabo, Baja California, including three males, ten females and one immature female (dried alcoholic) is in the author's collection.

Study of our entire series of the genus leads me to reverse that decision, dividing the single species represented into three races, two only of which occur in the United States. The features which distinguish the races of the Oedipodinae are often subtile and difficult. In the present case the species shows great unstability throughout the greater portion of Baja California, on the islands of the Gulf of California and probably in western Sonora, but all the other series are much more stable and the eastern and northern condition which is much the most widely distributed is therefore recognized as a race, for which Bruner's name is available.

The following material is before me, only locality and number of specimens being given for previously recorded material. 520; 276 males, 213 females and 31 immature individuals.

NEW MEXICO: Carlsbad, 3200 feet, VIII, 25, 1921, (M. Hebard; on limestone-strewn wash), 1♂, 1♀. Rinconada, 5987 feet, 1♀. Velarde, VII, 12, 1932, (M. J. Oosthuisen), 2♀, [Univ. of Minn. and Hebard Clns.]. Rancho del Monte, Santa Fé County, 6950 feet, 1♀. Otowi, 3 small juvs. Tijeras Canyon, Sandia Mountains, 6300 feet, VII, 29, 1919, (Rehn and Hebard), 1♂, 2♀. West base of Sandia Mountains, 5800 feet, VII, 29, 1919, (R. & H.; moderately common on bare sand of arroyo), 2♂, 13♀. Mesa east of Albuquerque, 5250 to 5500 feet, VIII, 8, 1921, (J. A. G. Rehn; moderately numerous), 6♂, 5♀. Corales, 5000 feet, VIII, 8, 1921, (J. A. G. Rehn; on bare ground), 1♀. Albuquerque, V, 22, 1883, 1♂, 1♀, *type* and *allotype* of *Thrincus aridus* Bruner; VII, 29, 1919 and VIII, 17, 1921, (R. & H ; on bare gravel and on bare wash), 1♂, 4♀. White Sands, VIII, 8, 1931, (R. H. Painter), 2♂, [Ks. Agr. Coll. and Hebard Clns.]. Alamogordo, 9♂, 9♀. San Antonio, VI, 22, 1921, (C. D. Duncan), 1♀, [Cal. Acad. Sci.]. Las Cruces, 1♂. Deming, 3♂. Lordsburg, VIII, 13, 1917, 3♂, [Cornell Univ.]. Steins, VII, 14, 1917, 1♂, [Hebard Cln.].

TEXAS: Langtry, 1400 feet, VIII, 24, 1912, (Rehn & Hebard), 1♀. Hackberry Creek, Brewster County, IX, 2, 1912, (Rehn & Hebard), 1♀. Garden Spring, IX, 2, 1912, (R. & H.), 1♀. Double Windmill, IX, 3, 1912, (R. & H.), 6♂. Persimmon Gap, 3000 feet, IX, 3, 1912, (R. & H.), 3♂. Bone Spring, IX, 9, 1912, (R. & H.; moderately numerous on pebbly volcanic soil at base of hills), 5♂, 4♀. Quail Spring, IX, 4, 1912, (R. & H.), 1♀. Phantom Lake in Davis Mountains, V, 30 and VI, 1, 1916, (F. M. Gaige), 1♂, 2♀, [Univ. of Michigan]. Marfa, VI, 5, 1908, 2♂, 4♀, [U.S.N.M.]. Presidio, IX, 18 and XI, 11, 1928, (E. R. Tinkham), 1♂, 1♀, [Hebard Cln.]. Valentine, VII, 13, 1927, (R. H. Beamer), 1♀, [Univ. of Ks.]. Sierra Blanca, IX, 13, 1912, (R. & H.; one among rock fragments on hillside), 1♂. Quitman Mountains, 4750 feet, (R. & H.; on pebbly wash), 1♀.

Fort Bliss, V, 1, 1915, (J. I. Carlson), 1♂, [Cal. Acad. Sci.]. Ysleta, IV, 2, 1902, (J. A. G. Rehn), 1 juv. ♀. Franklin Mountains, 3♂, 2♀. El Paso, 9♂, 7♀.

UTAH: Virgin, VII, 4, 1917, (G. P. Englehardt), 1♀, [Hebard Cln.]. St. George, VII, 1928, 1♂, [Hebard Cln.]. Mills Creek, Washington County, VI, 6, 1917, (G. P. Englehardt), 1♂, [Hebard Cln.]. Echo Farm, Washington County, 3500 feet, VI, 6, 1917, (G. P. Englehardt), 1♂, 2♀, [Hebard Cln.]. Santa Clara, Washington County, 3000 feet, IX, 6, 1926, (M. Hebard; on bare sandy soil near stream), 1♀. West slope of Beaver Dam Mountains, VII, 31, 1930, (E. R. Tinkham), 2♂, [Hebard Cln.]. 2700 to 4400 feet, IX, 7 and 9, 1926, (M. Hebard; four only seen on stones and pebbles of bare wash), 3♂.

NEVADA: Caliente, 2♀. Virgin River near Bunkerville, 1200 feet, IX, 7, 1926, (M. Hebard; pebbly wash near river), 1♂. St. Thomas, 1250 feet, IX, 8, 1926, (J. A. G. Rehn; on bare adobe of wash), 1♀. North end of Emigrant Valley, 5300 feet, VIII, 26, 1924, (R. & H.; few in gravelly wash), 2♂, 3♀. Lee Canyon, Spring Mountains, 4000 feet, VIII, 18 and 22, 1919, (R. & H.; few on pebbles in washes), 1♂, 2♀. Foothills of Bird Spring Mountains, 2♂, 1♀. Southwest slope of Cactus Range, 5800 feet, VIII, 14, 1924, (M. Hebard; on gravelly wash), 2♀. Millers, 4900 feet, VIII, 27, 1922, (M. Hebard; one on bare gravelly soil among desert brush), 1♂. Paymaster Camp, Paymaster Canyon, 4900 feet, VIII, 23, 1924, (R. & H.; on bare gravelly wash), 2♂. Spur of Lone Mountain east of Paymaster Canyon, Esmeralda County, 5600 feet, VIII, 23, 1924, (J. A. G. Rehn; on gravel), 1♂, 1♀. Beatty, VIII, 9 to 12, 1919, (R. & H.; few on dry gravelly beds of washes and of Amargosa River), 4♂, 4♀. Pilot Mountains, Esmeralda County, 5300 feet, IX, 3, 1910, (R. & H.; in canyon wash), 2♂. Mina, 4800 feet, IX, 3, 1910, (R. & H.; very scarce among bare rock fragments at foot of hills), 1♂, 1♀, 1 juv. ♀. Hawthorne, 4300 feet, IX, 12 and 13, 1919, (R. & H.; on sandy washes and on bare pebbly ground with some salt grass), 1♀, 4 medium small to small juv. ♀. Lucky Boy, Wassuk Range, 5000 feet, IX, 13, 1919, (R. & H.; on rock fragments in wash), 1♂. South shore of Walker Lake, 4100 feet, IX, 13, 1919, (R. & H.), 2♂. Mason, IX, 6, 1910, (R. & H.), 3♂, 3♀.

ARIZONA: Winslow, 4900 feet, VII, 30, 1919, (R. & H.; local and not abundant on bare areas of Painted Desert plain of reddish pulverized earth, noted that on the ground individuals made a whirring sound with the caudal femora), 18♂, 10♀, (all red-brown and with pronotum finely rugulose). San Bernardino Ranch, 4♂, 3♀, [Univ. of Ks.]. Douglas, 3985 feet, IX, 26, 1922, (R. & H.; very few on bare spots on gravelly bench), 1♂, 2♀; 2♂, 2♀, [Univ. of Ks.]. Benson, 3600 feet, X, 12, 1910, (R. & H.), 1 small juv. ♀. Carr Canyon, Huachuca Mountains, 1♀. Santa Rita Mountains, VIII, 18, 1935, (Beamer and Russell), 1♂, 1♀; 1♂, 3♀, [Univ. of Ks.]. Oracle, IX, 8, 1932, (E. R. Tinkham), 1♂. Sabino Canyon, Santa Catalina Mountains, III, 29 to V, 14, 1916, (J. F. Tucker), 10♂, 18♀ and III, 10 to IV, 8, 3 juv. ♂, 3 juv. ♀. Vail, VIII, 18, 1935, (J. Russell), 1♀.

Tucson, 1♂, 3♀; IV, 9, 1921, 1 large juv. ♀; IV, 24, (F. M. Jones), 1♂, [A.N.S.P.]. Sonora (or Ajo) road Canyon, Tucson Mountains, 2♂, 2♀, 1 juv. ♀. San Xavier Mission, VII, 24, 1916, (J. A. G. Rehn), 4♀, [A.N.S.P. and A.M.N.H.]. Sahuaro plain west of Tucson Mountains, 1♀. Roebles Ranch, Altar Valley, 1♂, 1♀. Buenos Aires Well, Altar Valley, 3850 feet, IX, 20, 1924, (R. & H.), 1♀. Roadside Mine, Coyote Mountains, 2800 feet, IX, 14, 1924, (R. & H.), 1♀. Kits Peak Rincon, Baboquivari Mountains, VII, 1 to 9, 1916, (J. A. G. Rehn), 3♂, 5♀, [A.N.S.P. and A.M.N.H.]. Santa Cruz Village, Cobabi Mountains, VIII, 10 to 12, 1916, (J. A. G. Rehn), 1♂. Ten miles east of Flagstaff, VII, 20, 1930, (E. R. Tinkham), 1♂. Grand Canyon (rim), VII, 11, 1892, 2♂. Indian Garden, Bright Angel Trail, Grand Canyon, VI, 9, 1916, (G. P. Englehardt), 1♂, 1♀. Dewey, VIII, 30, 1917, (O. C. Poling), 1♀. Prescott, VII, 29, 1932, (R. H. Beamer), 1♂, [Univ. of Ks.]; VII, 30, 1917, (O. C. Poling), 1♀. Bradshaw Mountain, VI, 22, 1892, 1♀, [U.S.N.M.]. Phoenix, 1♂, 2♀; IV, 6, 1914, (O. C. Poling), 1♂; VII, 10, 1932, (M. J. Oosthuisen), 2♂, 2♀, [Univ. of Ks. and Hebard Cln.]. Slopes south of Beaver Dam Mountains, Mojave County, 2700 feet, IX, 7, 1926, (R. & H.; very scarce on stones and pebbles of bare wash), 1♂, 1♀. Kingman, V, 25, 1920, (O. C. Poling), 1♀; VIII, 2, 1919, (R. & H.), 1♂, 3♀, 1 juv. ♂. Yucca, VI, 14, 1921, (C. D. Duncan), 1♂. Yarnell, VII, 27, 1933, (R. H. Beamer), 1♂, 1♀, [Univ. of Ks. and Hebard Clns.]. Congress Junction, 1♂. Mohawk, VII, 9, 1932, (M. J. Oosthuisen), 1♀. Sentinel, 686 feet, X, 2, 1910, (R. & H.; one on wash), 1♀. Valley of the Ajo, north of Ajo, 1600 feet, IX, 18, 1922, (R. & H.), 1♀. Ajo, III, 19, 1933, (E. D. Ball), 1 large juv. ♀; III, 27, 1923, (O. C. Poling), 1♂, 1 large juv. ♀; 1800 feet, IX, 18, 1922, (R. & H.; few on bare gravel slopes of dry stream bed and one at light at night), 4♂, 1♀. Growler Pass, Growler Mountains, 1300 feet, IX, 19, 1922, (J. A. G. Rehn; in wash), 1♀. Quitobaquita, 1050 feet, IX, 19, 1922, (M. Hebard; on bare pebbly soil near arroyo), 1♂. Bill Williams Fork, 1♂, 3♀, [Univ. of Ks.]. Alamo, VIII, 14, 1935, (J. Beamer), 1♂. Salome, V, 8 and 10, 1920, (O. C. Poling), 8♂. Quartzsite, IV, 20, 1903, 3♀, [A.N.S.P.]. Dome, 190 feet, IX, 11, 1924, (R. & H.; very few on pebbly washes), 2♂, 1♀. Yuma Desert west base of Gila Mountains, 400 feet, IX, 12, 1924, (M. Hebard; perched up in Palo Verde bush, one seen in wash), 1♂. Yuma, X, 1, 1910, (R. & H.); on pebbly washes), 5♂.

CALIFORNIA: Needles, 550 to 750 feet, VIII, 3 and 4, 1919, (R. & H.; moderately common in arroyo beds, particularly in pebbly areas), 13♂, 8♀. Goffs, 2584 to 2700 feet, VIII, 5, 1919, (R. & H.; locally in small colonies in arroyo beds), 6♂, 1♀. Lyons, 6370 feet, IX, 1, 1909, (R. & H.; moderately common), 5♂, 1♀. North range of Providence Mountains, 3♂, 2♀. Cima, 2♂. Kelso, 2♂. Jean, VI, 27, 1932, (M. J. Oosthuisen), 2♂, 2♀, [Univ. of Minn.]. Bagdad, 650 to 800 feet, VIII, 6, 1919, (R. & H.; occasional in gravelly areas in washes), 5♂, 5♀, 2 small juv. ♂. Hole in the Rock Spring, Boundary Canyon, Amargosa Range, 2500 to 2900 feet, VIII, 13, 1909, (R. & H.; few in wash), 2♂, 1♀, 1 small and 1 very small juv. ♀. Panamint Valley opposite Hall Canyon, 1500 feet, IX, 6, 1922, (R. & H.; very scarce in wash), 1♂, 1♀. Junction of Slate and Argus Ranges, 2750 feet, IX, 8, 1922, (J. A. G. Rehn; very few in pebbly wash), 1♂. Trona, 1750 feet, IX, 5 and 9, 1922, (M. Hebard; rare, adults in gravelly wash, immatures on finer gravel of plain), 1♂, 1♀, 1 small juv. ♀. Newberry, 1831 feet, IX, 9, 1924, (M. Hebard; few on bare gravelly wash), 2♂. Barstow, 2100 feet, VIII, 7, 1919, (R. & H.; on gravelly areas in washes), 7♂, 4♀, 2 small juv. ♀. Warren, 4000 feet, IX, 17, 1910, (R. & H.; few in wash), 5♂, 2♀. Mojave, VI, 28, 1932, (M. J. Oosthuisen), 1♂, 1♀, [Univ. of Minn.]; IX, 16, 1910, (R. & H.), 9♂, 4♀. Kern, San Joaquin Valley, 450 feet, IX, 5, 1910, (R. & H.; immatures occasional on bare sandy plain), 1 juv. ♀. Cuddy Canyon, Ventura Mountains, 4472 feet, IX, 4, 1922, (R. & H.), 1♂. Downer Ranch near Mount Pinos, Ventura Mountains, 5200 feet, IX, 3, 1922, (R. & H.), 2♂. Victorville, IX, 1, 1919, (R. & H.; very few on bare sandy ground), 2♂, 1♀. Cushenbury Ranch, 4100 feet, VIII, 31, 1919, (M. Hebard; one on bare wash of white granite sand and boulders), 1♀. Indio, 50 feet, VIII, 5, 1935, (J. Russell), 1♂, [Univ. of Ks.]; IX, 17, 1922, (R. & H.; scarce on granite gravel in wash), 2♂, 3♀. Palm Springs to Palm Canyon, 450 to 800 feet, IX, 29, 1910, (R. & H ; general but not abundant in washes of white granite gravel), 15♂, 4♀, 1 very small juv. ♀. El Centro, below sea level, VIII, 25, 1931, (E. R. Tinkham), 1♂. Coyote Well, 270 feet, IX, 16, 1922, (R. & H.), 1 small juv. ♀. Five miles west of Coyote Well, 600 to 750 feet, IX, 16, 1922, (R. & H.; on bare gravel of wash), 6♂, 3♀. Mountain Spring, IX, 16, 1922, (M. Hebard; on bare gravel wash), 1♂, 1♀.

Typical material of this race has also been recorded from northern Mexico. The problems confronting the student in material from western Sonora and the islands of the Gulf of California require more thorough analysis with even larger series than are yet available to delimit definitely the races and intergrades in those regions.

From the series before me it is evident that this insect prefers pebbly or coarse gravelly areas in washes particularly near or at the bases of the desert hills and mountains of the southwestern United States, but is able to reach considerable elevations (as high as 6950 feet) in such environment. It is very often encountered, but is seldom numerous and almost disappears in the dry and hot valleys. Adults are present almost throughout the year as well as small immatures. I am inclined to believe, however, that the largest number of adults are present from May to early July over most of its range.

The color variation in all of the races of *parviceps* is great. Not only does the general ground color vary from very dark grays, browns and rich red-browns to very light gray, buff and white, but the usually rather coarse and scattered dark dots may be in either extremely sharp or in weak contrast, while sometimes these markings greatly increase in number and become much smaller and more regular, giving a distinctive speckled appearance. Moreover the wings may be faintly tinged with dull light yellow (usually in the east), greenish or bluish (usually in the west), while the wing apices show decided (usually in the east) to slight suffusion, or are immaculate (usually in the west).

The fact that some of the above differences have a definite geographic correlation suggests further incipient racial differentiation, but the two western races of the species are in certain of their areas of distribution definitely more variable than *parviceps arida*.

**Cibolacris parviceps californica** (Thomas)

1874. *Thrincus californicus* Thomas, Bull. U. S. Geol. and Geogr. Surv. Terr., I, Bull. 2, 1st Ser., p. 66. [♂, ♀; southern California.]

Typically this insect differs from *parviceps arida* in the more robust form and shorter organs of flight and limbs. The pronotal surface is more frequently rough but, as in that race, this is a highly variable feature, individuals sometimes having it very smooth. Moreover such rugosity appears to have a direct relation to immediate environmental conditions and rich red-brown individuals of this insect as well as of *parviceps arida,* taken on bare rich red-brown soil, show its strongest development.

Much the smallest and most robust individuals with shortest organs of flight come from the lowlands from Riverside and Pasadena, California, south to Hamilton's Ranch, Baja California[28] and San Diego, California. The most appreciable divergence toward *parviceps arida* is found in the material recorded from the San Jacinto and Santa Rosa Mountains.

*Specimens examined:* 81; 25 males, 55 females and 1 immature individual.

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[28] I reported this southern limit in 1931 (Trans. Amer. Ent. Soc., LVII, p. 121). The locality is at 500 feet on the Pacific slope of the northern mountains of Baja California. At that time the correlation of color and rugosity with conditions of immediate environment was first discussed.

CALIFORNIA: Mill Creek, San Bernardino Mountains, 4200 feet, VIII, 30, 1919, (R. & H.), 1 very small juv. ♀. Kenworthy, San Jacinto Mountains, 5000 feet, VI, 1924, (F. Grinnell Jr.), 2♀, [A.N.S.P. and Hebard Cln.]. Idyllwild, San Jacinto Mountains, VII, 3, 1930, (P. H. Timberlake), 2♂, 4♀, [Hebard Cln. and U. of Cal. Coll. Agr. So. Cal.]; VIII, 3, 1935, (J. Russell), 2♀, [U. of Ks. and Hebard Cln.]. Dos Palmas Springs, Santa Rosa Mountains, 3500 feet, V, 26 to VI, 1, (F. Grinnell Jr.), 5♀, [A.N.S.P.]. San Bernardino County, IV, 1♀. Riverside, III, 12, 1926, (H. Compere), 1♀; III, 30 to IV, 10, 1926 to 1930, (P. H. Timberlake), 3♀ (two rich red-brown). Cucamonga, 2♂. Mesa, 1♂. Claremont, (C. F. Baker and others), 3♂, 10♀, [Hebard Cln., Cornell and Univ. of Ks.]. Arroyo Seco Canyon, San Gabriel Mountains, 1♂. La Crescenta Valley, head of Verdugo Canyon, IV, 13, 1916, (F. Grinnell Jr.), 1♀, [A.N.S.P.]. La Canada Valley, 1600 feet, III, 14, 1914, (F. Grinnell Jr.), 1♀, [A.N.S.P.]. Pasadena, IV, 2 to V, 5, 1898 to 1910, (F. Grinnell Jr.; some in Eaton Wash), 1♂, 8♀, [A.N.S.P. and Hebard Cln.]. Los Angeles County, 1887, (D. W. Coquillett), 2♂, 1♀. Anaheim, (D. W. Coquillett), 1♀. Jacumba, 2800 feet, IX, 13, 1922, (M. Hebard; one on coarse granite sand of wash), 1♂; VIII, 12, 1935, (R. H. Beamer Jr.), 3♂, 1♀, [U. of Ks. and Hebard Cln.]. Anza, VIII, 6, 1935, (J. Russell), 1♂. Campo, 2400 feet, VIII, 10, 1935, (Beamer & Russell), 2♂, 1♀, [U. of Ks.]; IX, 13, 1922, (R. & H.; very few widely distributed on bare light red-brown granite gravel), 3♂, 2♀. Pine Valley, VI, 1921, (G. H. Field), 1♂, 3♀, (light red-brown). San Felipe Valley, VII, 24 to 28, 1920, (G. H. Field), 1♂, 2♀. San Diego, III, 12 to IV, 29, 1916 to 1921, (G. H. Field), 3♀, (deep red-brown); III, 21 to 29, 1900, (G. W. Dunn), 1♂, 4♀, [A.N.S.P.].

The remarks under *parviceps arida* are in large part equally applicable to the present race. It is confined to the Pacific drainage in the western portion of southern California and probably a narrow adjacent area in Baja California, where adults appear as early as the beginning of March. By early Fall adults are usually absent and when found decidedly few in number.

## SPANIACRIS new name

1906. *Ramona* Bruner (not of Casey 1886 (Coleoptera)), Biol. Cent. Amer., Orth., II, p. 186.

GENOTYPE, by monotypy: *Spaniacris deserticola* (Bruner). (Pl. XXIII, figs. 4 and 5.)

This remarkable genus and species was described from a single female, taken at Indio, California, by H. F. Wickham and now in the author's collection.

During all of our trips through the Colorado and Mojave Deserts the living insect remained unknown to Rehn and me until 1922 when at Kane Spring in the Salton Sink we located a small colony. All were near some sand dunes northwest of Kane Spring in an area of less than an acre on a flat sandy wash strewn with fragments of sandstone. "Two females were taken on smooth loam between gray desert brush, not two feet apart, the others scattered widely where a slender-stemmed open green plant about two feet high was the only vegetation. One male flew a long distance, though not rapidly, in a low direct flight quite unlike that of *Anconia*. The others crawled and hopped about, flying only short distances, likewise in a distinctive low direct manner except some of the females which fluttered up and seemed incapable of flying more than a few feet at a time, fluttering with tegmina only partially spread as is often the manner in *Tytthotyle*.[24] Both sexes on the ground assumed a posture like that of *Coniana*, pressed close to the sand with legs all raised in a spider-like fashion (the long legs suggest that individuals probably walk about with body well raised, squatting down only when alarmed). It required nearly an hour of very strenuous quartering of this furnace-hot and blinding area to secure seven specimens".

In 1931 I asked E. R. Tinkham to make particular efforts to find this insect in the same region and he and his brother located a single much larger colony east of Coyote Wells on a very low sandy ridge among low gray-green cespitous sand-loving plants, there associated with *Coniana snowi* Caudell. They found both sexes flying in the same low direct manner and toward evening when coitus was taking place females were seen to fly with the much smaller males still attached to them. Several hours were taken in securing practically the entire colony.

Males agree closely with females except in being more slender and very much smaller. Their color is identical, whitish delicately blotched and marked with light to dark brown. The wings are glassy, weakly tinged with an extremely pale dull green (glaucous of Ridgway). The most striking feature is the smoothly and moderately constricted pronotum from which the head protrudes upward and slightly forward to an exceptional degree.

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[24] Possibly these were gravid. See notes as to females secured by Tinkham.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Caudal widt of pronotal disk | Length of tegmen | Length of caudal femu |
|---|---|---|---|---|---|
| ♂ | | | | | |
| Near Kane Spring ....... | 19.8-21. | 3.7-3.8 | 3. -3.3 | 16.9-18.1 | 10.5-11.7 |
| Near Coyote Wells ....... | 20.2-21.6 | 3.8-3.9 | 3. -3.2 | 17.3-19.1 | 11.1-11.7 |
| ♀ | | | | | |
| Indio, *Type* .............. | 31. | 5.9 | 4.2 | 29.8 | 16.7 |
| Near Kane Spring ....... | 32.8-35.3 | 5.9-6.1 | 4.4-4.5 | 30.2-32. | 17.8-18.4 |
| Near Coyote Wells ....... | 33.7-34. | 6. -6.4 | 4.3-5. | 30.2-31.8 | 17.1-18.2 |

Seventeen males and eleven females of *Spaniacris deserticola* are now before me.

CALIFORNIA: Indio, Salton-Imperial depression (Conchilla Valley), 75 feet below sea level, (H. F. Wickham), 1♀, *type*, Hebard Collection No. 79. Six miles northwest of Kane Spring, Salton-Imperial depression (Salton Sink), 75 feet below sea level, IX, 17, 1922, (Rehn and Hebard), 4♂, 3♀. Ten miles east of Coyote Wells, Salton-Imperial depression (west rim of Imperial Valley), at sea level, VIII, 25, 1931, (E. R. Tinkham), 13♂, 7♀.

The genera nearest to *Spaniacris* are *Anconia* Scudder 1876, with genotype by monotypy *integra* Scudder 1876; *Xeracris* Caudell 1915, with genotype by monotypy *Heliastus minimus* Scudder 1900, and *Coniana* Caudell 1915, with genotype by monotypy *snowi* Caudell 1915.

In sequence I would place them as follows: *Anconia, Xeracris, Coniana, Spaniacris.* They form a natural group which may be called the Group Anconiae, distinguished from the nearest allies by the very slender limbs, moderately to strikingly sellate pronotum, moderately to decidedly produced head dorso-cephalad, prominent eyes, comparatively short antennae and immaculate wings. Much nearest in general appearance is the genus *Cibolacris* here described which is placed last in the preceding Group Heliasti.

The resemblance of *Spaniacris* to *Heliastus* is much the closest as the other genera include much smaller species, but it agrees better with them in general structure of vertex and is evidently nearest *Coniana,* these two distinguished by the narrow frontal costa, pitted pleura and broad mesosternal and metasternal interspaces.

Compared with *Anconia* I find *Spaniacris* has the pronotum much more sellate, the head decidedly more produced dorsocephalad with postocular area considerably broader, eye short, vertex of different shape and without fine lateral carinae but with a fine medio-longitudinal carina, unusually narrow tegmina which lack an intercalary vein, pleura pitted, caudal tibiae with fewer (eight) external spines and a more elongate pair of distal spurs.

The above genus is the last of the Oedipodinae which occurs in the United States. Though *Heliaula* Caudell 1915, with monotypic genotype *Aulocara rufum* Scudder 1899, has been placed at the end of the Oedipodinae, I believe that it is actually a highly aberrant member of the Acridinae which should be placed after *Aulocara* though representative of a very different unit.

In *Heliaula* the head is more rounded and the fastigium broader than in any other North American Acridine, resembling to some extent *Zapata* Bruner in general appearance.

The large full head might suggest *Eupnigodes* McNeill but again the vertex and frontal costa are decidedly wider. The internal spurs of the caudal tibiae are equal and moderately elongate and the carina ventrad on the internal surface of the caudal femora is closely toothed.

## EXPLANATION OF PLATES

### PLATE XXI

Fig. 1.—*Timema ritensis* new species. Male. *Type*. Old Baldy, Santa Rita Mountains, Arizona. Dorsal view of distal portion of abdomen and its appendages. (Much enlarged.)

Fig. 2.—*Spharagemon superbum* new species. Male. *Type*. Katherine, Willacy County, Texas. Dorsal view. (× 2.)

Fig. 3.—*Spharagemon superbum* new species. Male. *Type*. Katherine, Willacy County, Texas. Lateral view. (× 2.)

### PLATE XXII

Fig. 1.—*Diapheromera velii eucnemis* new subspecies. Male. *Type*. Marathon, Brewster County, Texas. Dorsal view. (× 8.)

Fig. 2.—*Diapheromera velii eucnemis* new subspecies. Female. *Allotype*. Marathon, Brewster County, Texas. Dorsal view. (× 8.)

Fig. 3.—*Opeia atascosa* new species. Male. *Type*. Southwest slopes of Atascosa Peak, Pajarito Mountains, Arizona. Lateral view. (× 1.6.)

Fig. 4.—*Opeia atascosa* new species. Female. *Allotype.* Southwest slopes of Atascosa Peak, Pajarito Mountains, Arizona. Lateral view. (× 1.6.)

Fig. 5.—*Cibolacris parviceps arida* (Bruner). Female. Trona, California. Dorsal view. (× 1.9.)

Fig. 6.—*Cibolacris parviceps californica* (Thomas). Female. Idyllwild, San Jacinto Mountains, California. Dorsal view. (× 2.25.)

## Plate XXIII

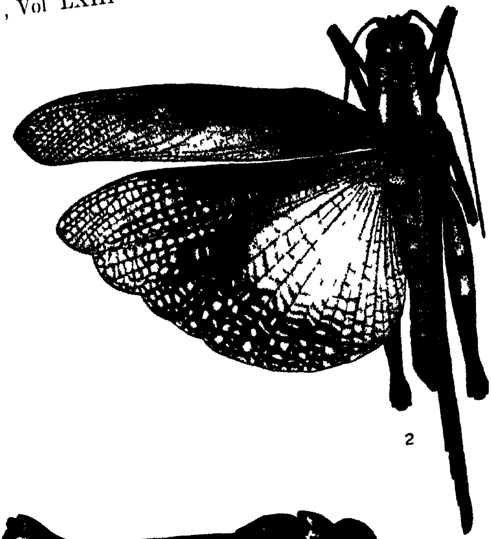
Fig. 1.—*Amphitornus coloradus saltator* new subspecies. Female. *Allotype.* Pass between Ely and Osceola in Shell Creek Range, White Pine County, Nevada. Lateral view. (× 2.2.)

Fig. 2.—*Cibolacris parviceps arida* (Bruner). Male. Foot of Sandia Mountains, New Mexico. Lateral view. (× 1.2.)

Fig. 3.—*Cibolacris parviceps californica* (Thomas). Male. Arroyo Seco Canyon, San Gabriel Mountains, California. Lateral view. (× 1.28.)

Fig. 4.—*Spaniacris deserticola* (Bruner). Male. East of Coyote Wells, Salton-Imperial Depression, California. Lateral view. (× 1.9.)

Fig. 5.—*Spaniacris deserticola* (Bruner). Female. East of Coyote Wells, Salton-Imperial Depression, California. Dorsal view. (× 1.25.)



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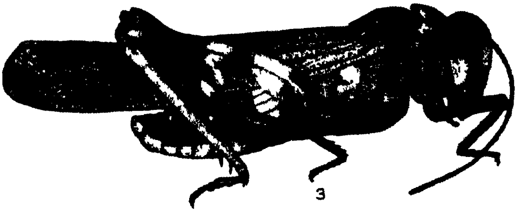

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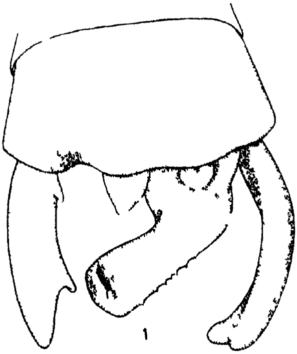

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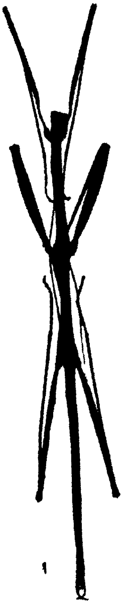
HEBARD—NORTH AMERICAN ORTHOPTERA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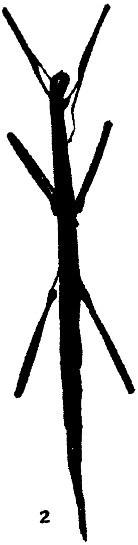
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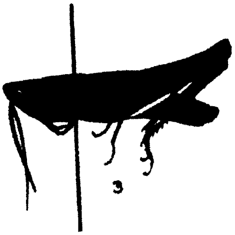
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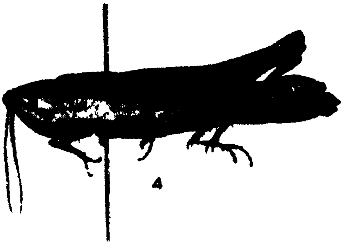
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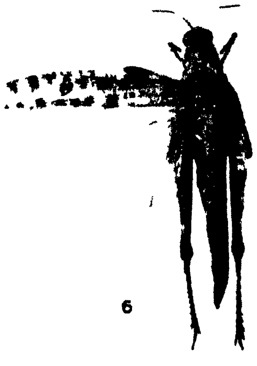
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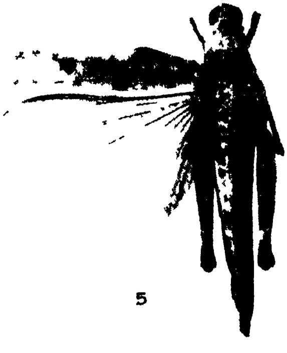
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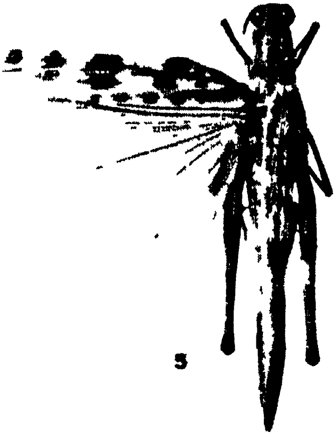

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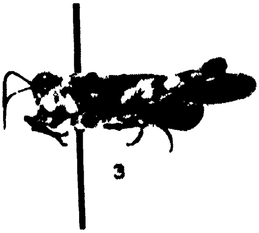

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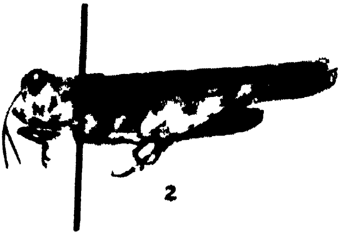

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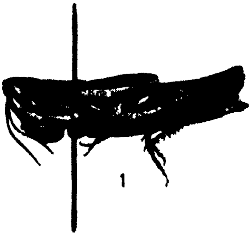

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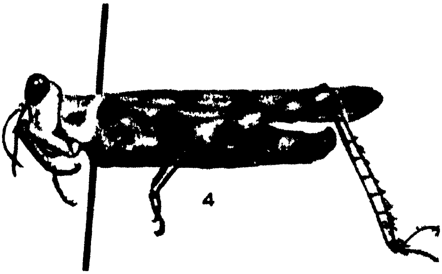

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HEBARD—NORTH AMERICAN ORTHOPTERA

# A REVISION OF THE GENUS MEGACHILE IN THE NEARCTIC REGION[1]

## PART VIII[2]

### TAXONOMY OF THE SUBGENUS CHELOSTOMOIDES, ADDENDA AND INDEX

**(Hymenoptera: Megachilidae)**

BY THEODORE B. MITCHELL

(Plates XXVI–XXIX)

*Chelostomoides* seems to be chiefly Nearctic, although it includes a few Neotropical representatives, and at least one, *M. spissula* Cockerell from Formosa, from outside these two regions. The full extent of its range cannot be stated until the Genus *Megachile* has been more intensively studied throughout its world-wide range.

*Oligotropus* Robertson and *Sarogaster* Robertson have been made synonyms of *Chelostomoides,* since there seems to be no essential difference of apparent subgeneric value between the species of these three groups as defined by Robertson. The labial and maxillary palpi of all three seem to be similar, and the absence of basal teeth on the claws and the characters of the abdomen would seem to indicate the common relationship of all of these. The characters used in separating them (i. e., shape of mandible and clypeus in the female, and the presence or absence of coxal spines, inferior mandibular projections, and the modifications of the front tarsi in the males) are apparently subject to much variation, and one set of characters as seen in the female is not necessarily correlated with another combination of characters in the male. The characters seem to be too variable to use in a generic or subgeneric sense.

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[1] Contribution from the Department of Zoology and Entomology, North Carolina State College, published with the approval of the Director of the North Carolina Experiment Station as Paper No. 97 of the Journal Series.

[2] Parts I–VII. Trans. Am. Ent. Soc. LIX, pp. 295–361, (1934); LXI, pp. 1–44, (1935); LXI, pp. 155–205, (1935); LXII, pp. 117–166, (1936); LXII, pp. 323–382, (1937); LXIII, pp. 45–83, pp. 175–206, (1937).

### Subgenus **CHELOSTOMOIDES** Robertson

*Chelostomoides* Robertson, Can. Ent., xxxiii, p. 231, 1901. Robertson, Trans. Am. Ent. Soc., xxix, p. 167, 1903.

*Oligotropus* Robertson, Trans. Am. Ent. Soc., xxix, p. 167, 1903. Cockerell, Entomologist, xli, p. 292, 1908.

*Gnathodon* Robertson (nec. Oken), Trans. Am. Ent. Soc., xxix, p. 167, 1903.

*Sarogaster* Robertson, Ent. News, xxix, p. 92, 1918.

Tongue: First joint of labial palpus usually longer than the second, subequal in some species; maxillary palpi rather conspicuously pubescent.

*Female.*—Mandible lacking any definite cutting edge; clypeus very variable; basal joint of flagellum usually shorter than pedicel (subequal in *davidsoni*), the second joint usually somewhat longer than the first; mid and hind metatarsi much shorter and narrower than their tibiae; abdomen narrow and parallel-sided, at least the second and third terga with deep basal grooves which are often, but not always, fasciate; sixth tergum nearly vertical in position, quite strongly convex to near the tip where it is terminated by a pronounced shelf-like lip; sixth sternum densely and uniformly covered with scopal hairs.

*Male.*—Mandible 3-dentate, with or without an inferior projection; basal joint of flagellum usually subequal to pedicel, the second joint much longer; cheeks simple below; front coxae spined or not, and either pubescent or largely bare, but usually with little evidence of red bristles; front tarsi variable, dilated or simple; mid tibial spur present; abdomen narrow and parallel-sided, the terga grooved basally and these grooves conspicuously white fasciate; carina of sixth tergum usually very low and inconspicuous.

Male sternites: Fourth sternum entirely hidden, but unmodified; fifth sternum variable, usually much modified, with distinct pre- and medasternites, the posternal strip usually closely united with the medasternite and often obscure, the medasternal setae usually specialized; sixth sternum with variable medasternal areas, these usually but not always separated medially, the poststernal lobe extensive, very broad, not angulate.

Genital armature: Stipites simple, the tips often flexed or dilated, sometimes narrowed or compressed, never lobate; sagittae usually somewhat shorter than stipites, but relatively robust; volsellae robust.

GENOTYPE: *Chelostomoides rugifrons* Smith.

Observations have been made of the nesting habits of two species of *Chelostomoides* which indicate a marked departure from the usual type in *Megachile.* Rau (1926) observed a female of *campanulae* entering a burrow in a clay bank, and upon examining the contents of this burrow found it to contain a quantity of resinous material. This suggested, without positive proof, that the species used resin instead of leaves in the construction of its nest. This was practically substantiated by the observation of Hicks (1927) of the nest of *subexilis*, a closely related species. He found the nests in an almost vertical sandstone cliff. The entrances were plugged with resin, and the cocoon inside the burrow was surrounded with resin, with no leaves in evidence.

Just how universal this habit is throughout this subgenus can be determined only by many more observations, coupled with authentic determinations of the species concerned. If it proves to be universal throughout the group, it will constitute additional evidence that the limits of the group as here defined are correct. If not, it will indicate the possibility that the group should be further subdivided.

## *Key to Species of Chelostomoides*

### Females

1. Clypeus much modified, either produced, deeply excavated, or prominently lobed or angulate ........................................2
   Clypeus less modified, flattened, either entire apically or dentate or emarginate ........................................11
2. Mandibles long and slender, 3-dentate apically, without basal prominences ........................................3
   Mandibles usually broadened apically, either 4- or 5-dentate, often with conspicuous basal prominences or spines ..................7
3. Apical margin of clypeus with two prominent acute projections. *odontostoma* Cockerell
   Clypeal margin without acute projections ........................4
4. Upper margin of clypeus and the supraclypeal area protuberant, apical clypeal margin with a broad deep median emargination, the resulting lateral lobes only slightly broader than the width of this emargination ........................................*felipiana* new species
   Clypeus not emarginate medially ........................................5

5. Clypeus consisting of a narrow bowed projection just beneath the antennae, the surface below this projection broad, impunctate and polished .....................................*discorhina* Cockerell
   Clypeus either excavated or produced medially, not as above ........6
6. Clypeus excavated medially, slightly produced on each side. *rugifrons* Smith
   Clypeus produced medially or with a median tubercle ....*longula* Fox
7. Mandible with a conspicuous basal tooth or projection .............8
   Mandible with an inconspicuous basal tooth or none ..............10
8. Clypeus consisting of two prominent triangular acute lobes projecting forward at right angles to the face ............*davidsoni* Cockerell
   Clypeus conspicuously 3-lobed ......................................9
9. Lobes of clypeus subequal, the basal mandibular tooth relatively small .......................................*ignacensis* Mitchell
   Median clypeal lobe much larger than the lateral lobes, and impressed medially; basal mandibular projection broad and conspicuous. *lobatifrons* Cockerell
10. Clypeus conspicuously 3-lobed ......................*occidentalis* Fox
    Clypeus transverse, neither lobate nor excavated, the upper face medially slightly shorter than the polished lower face. *manni* Mitchell
11. Clypeal margin entire, neither denticulate nor emarginate. *georgica* Cresson
    Clypeal margin either denticulate, tuberculate or emarginate .......12
12. Mandible definitely 5-dentate ..................*spinotulata* Mitchell
    Mandible 4-dentate, or but very indistinctly 5-dentate ............13
13. Clypeal margin with at least a slight median denticle ..............14
    Clypeal margin definitely emarginate medially, with no indication of a median denticle ..............................................15
14. Clypeus with a shallow and quite narrow median emargination, this with a very slight median denticle; fifth abdominal tergum white fasciate .............................................*exilis* Cresson
    Clypeus with a shallow but very broad median emargination, this with a distinct median tubercle; fifth tergum not fasciate. *subspinotulata* Mitchell
15. Clypeal margin with a narrow median emargination and an equally deep but broader one on each side ..............*subexilis* Cockerell
    Clypeal margin without conspicuous lateral emarginations .........16
16. Fifth abdominal tergum white-fasciate; western. ..*angelarum* Cockerell
    Fifth tergum not fasciate; eastern ................................17
17. Sixth abdominal tergum with entirely pale pubescence; wings lightly infuscated; smaller (10-11 mm.) .............*campanulae* Robertson
    Sixth tergum with short erect black hairs in addition to the whitish tomentum; wings quite deeply infuscated; larger (11-12 mm.). *campanulae* var. *wilmingtoni* Mitchell

### Males

1. Mandible without an inferior projection ..........................2
   Mandible with a definite inferior projection ........................8
2. Carina of sixth tergum conspicuously produced but very narrow, longer than broad, the apex very slightly emarginate ..*lobatifrons* Cockerell
   Carina very low, either bidentate or with only a slight median emargination ..........................................................3
3. Clypeal margin with two prominent tubercles ........*manni* Mitchell
   Clypeal margin with at most but a slight median tubercle ...........4
4. Carina of sixth tergum deeply emarginate, or bidentate .............5
   Carina very low and inconspicuous with a barely evident median emargination ..................................................6
5. Scutellum shining, almost impunctate ............*discorhina* Cockerell
   Scutellum closely and distinctly punctate ............*pratti* Cockerell
6. Clypeal margin straight, subentire; punctures of vertex coarse and closely crowded; anterior face of front and mid tibiae ferruginous; larger (9 mm.) ..................................*rugifrons* Smith
   Clypeal margin with slight emarginations, either medially or laterally; vertex more finely punctate; front and mid tibiae entirely dark; smaller (8 mm. or less) .....................................7
7. Clypeal margin with rather deep lateral emarginations, the edge between them somewhat produced, straight; vertex shining between the distinctly separated punctures; second joint of flagellum about four times the length of the first .................*browni* Mitchell
   Clypeal margin with low, subequal median and lateral emarginations; vertex dull, the punctures very close; second joint of flagellum about three times the length of the first ...............*duplexa* Mitchell
8. Front tarsi dark, only slightly dilated and flattened ...............9
   Front tarsi ferruginous, at least the basal joints distinctly dilated and flattened ..............................................12
9. Fourth and fifth abdominal terga with black pubescence.
   *angelarum* Cockerell
   Pubescence of fourth and fifth terga entirely pale .................10
10. Front coxae with short but definite spines .........*subexilis* Cockerell
    Coxal spines reduced to minute tubercles ..........................11
11. Wings but slightly infuscated; smaller (9 mm.) ..*campanulae* Robertson
    Wings strongly infuscated; larger (11 mm.).
    *campanulae* var. *wilmingtoni* Mitchell
12. Apical joint of front tarsus distinctly longer than the basal joint ....13
    Front metatarsus distinctly longer than the apical tarsal joint ......14
13. Surface shining between fine well-separated punctures on cheeks below; mesonotum with two conspicuous anterior oblique patches of white tomentum ....................................*occidentalis* Fox
    Cheeks below ruguso-punctate; mesonotum with merely fine lines of white tomentum anteriorly ...................*davidsoni* Cockerell

14. Front coxae definitely spined ....................................15
    Coxal spines reduced to minute tubercles ..........................16
15. Mesosternum with a sharp spine just behind each front coxa.
    *spinotulata* Mitchell
    Mesosternum not spined ............................*georgica* Cresson
16. Third joint of front tarsus much narrower than the second joint.
    *exilis* Cresson
    Third joint of front tarsus subequal in width to the second joint.
    *exilis* var. *parexilis* new variety

**Megachile (Chelostomoides) angelarum** Cockerell
(Pls. XXVI, XXVII, XXVIII.)

*Megachile angelarum* Cockerell, So. Calif. Acad. Sci. Bull., I, p. 70, 1902. Cockerell, Entomologist, XLI, p. 292, 1908.

*Female.*—Size: Length 10-11 mm.; breadth of abdomen 3 mm.; anterior wing 7 mm.

Structure: Clypeus flat, apical margin with a deep rectangular median emargination, slightly denticulate laterad of this; mandible broad apically, 4-dentate; vertex rounded; lateral ocelli subequally distant from eyes and edge of vertex; basal grooves of abdomen distinct, each with a sharply carinate anterior margin, and third to fifth terga strongly depressed apically for entire width.

Puncturation: Close, deep and rather fine on face, vertex and dorsum of thorax, more coarse on clypeus and on pleura above, finer on cheeks and propodeum; very fine and close on basal and apical abdominal segments, coarse and relatively sparse on the second to fourth laterally, more close and fine medially, close but rather coarse on the fifth.

Color: Black; antennae ferruginous beneath; tegulae and legs obscurely reddish; wings subhyaline, the nervures brownish-ferruginous; spurs yellow.

Pubescence: Thin and whitish throughout, except for short erect black hairs on the fifth abdominal tergum; first to fifth terga with entire and distinct white apical fasciae, and the basal grooves of the second to the fourth white-fasciate; scopa white, black on the sixth sternum.

*Male.*—Size: Length 9-10 mm.; breadth of abdomen 2 mm.; anterior wing 6 mm.

Structure: Clypeal margin with a prominent tubercle on each side of middle; mandible 3-dentate, with a distinct median inferior projection; lateral ocelli subequally distant from eyes and edge of vertex; coxal spines reduced to distinct sharp denticles; first to third joints of front tarsi moderately dilated, flattened, the first equal to the other two combined in length, the second rectangular, nearly as wide as the tibia; second to fifth abdominal terga with deep basal grooves and deeply depressed apically for entire width; carina of sixth tergum very low, with a broad shallow median emargination.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite much longer than broad, the median portion long linear, the medasternite broad, shorter medially than laterally, with sparse flattened setae, but the median line non-setose, the poststernal strip broadly incurved medially; lateral portions of sixth presternite about as broad as long, the medasternal areas with fine closely set setae, distinctly separated medially, each with a long, slightly curved and oblique carina, the poststernal lobe rather membraneous, very broad and extensive.

Genital armature: Stipites narrowed above base, gradually dilated and more or less obliquely compressed toward the rounded (and slightly flexed) tips; sagittae shorter and less robust than stipites; volsellae robust, apices broad and slightly incised or emarginate.

Puncturation: Moderately close and deep on face, vertex and dorsum of thorax; much more fine and close on cheeks; coarse and deep on clypeus; deep on abdomen, fine and close on basal segment, fine but more sparse on second to fourth terga medially but coarse laterally, very close and fine on the fifth and sixth.

Color: Black, including front tarsi; antennae slightly reddened beneath; tegulae piceous to blackish; wings subhyaline, slightly clouded apically, the nervures piceous to ferruginous.

Pubescence: Thin and white throughout except for short erect black hairs on fourth to sixth abdominal terga, the basal grooves of the third to the sixth conspicuously white-fasciate, the first and second terga with apical fasciae evident laterally.

*Type.*—Female; Southern Colorado, 1893, (Dr. A. Davidson), [Cockerell].

*Range.*—Arizona, California, Nevada, Oregon and Washington, May to September. Definite records are as follows:

CALIFORNIA: 1♂, 4♀, Altadena, June 7-July 31, (on *Lotus scoparius* and *Cordylanthus rigidus*). 3♂, 3♀, Big Bear Lake, San Bernardino County, July 15-Aug. 21. 2♂, Bluff Lake, San Bernardino County, July 15 & 16, 1934. 7♂, Crystal Lake, San Gabriel Mts., July 7, 1934, (on *Verbena prostrata*). 1♀, Eagle Rock, July 1, 1936, (on *Lotus*). 1♂, 1♀, Florence Lake, Sierra Nevada Mts., Fresno County, July 1931. 1♂, 1♀, Hospital Rock, Sequoia Nat. Park, Sep. 4, 1933, (on Dove Weed). 1♀, Idyllwild, San Jacinto Mts., Aug. 16, 1934. 1♀, La Crescenta, May 13, 1934, (on *Lotus scoparius*). 4♂, 1♀, Los Angeles, July 16, 1933, (on *Encelia* sp. and *Phacelia ramosissima*). 1♂, Mill Creek, San Bernardino County, Sep. 1, 1930. 2♂, Mineral King, Tulare County, Sep. 3, 1933, (on *Aster*). 2♂, 7♀, Pasadena, May 12 to Aug. 11, (on *Palo Verde, Vetix* and *Pentstemon*). 2♀, San Gabriel Canyon, Los Angeles County, May 23 and July 7. 5♂, 1♀, Tokopah Valley, Sequoia Nat. Park, Aug. 21 and Sep. 1, 1933, (on *Eriogonum Wrightii, Rudbeckia Californica* and Queen Ann's Lace); 1♂, Wolverton Creek, Sequoia Nat. Park, Aug. 30, 1933, (on *Lotus*); (all Michener). 1♂, Big Pine Creek, Glacier Lodge, 8000-11000 ft., Inyo County, Aug., 1929. 3♂, Cajon Pass, San Bernardino County, July 2, 1934. 1♂, 1♀, Berkey, Riverside County, June 24, 1934. 2♂, 1♀, Big Bear Lake Road, San Bernardino Mts., July 9, 1934; 9♂, Big Bear Lake, San Bernardino County, July 7, 1934; (all Isabel McCracken). 1♀, Lake Almanor, Plumas County, July 13, 1934; 1♂, Cazadero, Sep. 2, 1918. 1♂, Clayton, Shasta County, July 10, 1913; 1♂, Huntington Lake, July 7; (all E. P. Van Duzee). 1♂, Strawberry Valley, El Dorado County, Aug. 9, 1912; 3♂, 2♀, Idyllwild, June 23 to July 8, 1928; 1♀, Yosemite Valley, June 30, 1931; 1♂, Paradize Valley, Fresno County, July 15, 1910; 1♀, Big Flat, Coffee Creek, Trinity County, June 22, 1934; 1♂, 3♀, Carrville, Trinity County, June 24-28, 1931; 10♂, 11♀, Meadow Valley, Plumas County; 3500-5000 ft., June 8 to July 11, 1924. 1♂, Banning, May 28, 1928; 1♂, Kings River Canyon, Fresno County, July 6, 1910; 2♀, Twin Rocks, Mendocino County, July 10, 1929; (all E. C. Van Dyke). 1♂, Giant Forest, Tulare County, July 12, 1923; 1♂, 1♀, Mineral King, Tulare County, July 30-31, 1922; (all C. L. Fox). 1♂, 2♀, Carrville, Trinity County, 2400-2500 ft., June 11 & 18, 1934; 2♂, Mineral King, July 30 & 31, 1935; (all G. E. Bohart). 1♂, Carson Pass, 8000 ft., Sep. 2, 1934, (G. E. & R. M. Bohart). 1♂, Putah Canyon, Yo-Solano County, June 4, 1936, (R. M. Bohart). 2♂, 1♀, Los Angeles, June 21 & 28 and July 5, 1926; 1♀, Pasadena, June 27, 1928; (all Hicks). 3♂, Altadena, July 3, 1936, (Gartz). 2♂, 2♀, American River, Placer County, Aug. 20, 1916. 2♂, 2♀, Auburn, July 23, 27 and Aug. 28, 1915. 2♂, Friant, May 24, 1936, (M. Cazier). 3♀, Idyllwild, June 26, 1936, (M. Cazier). 1♂, near Harden Lake, Yosemite Park, July 20, 1930, (E. C. Zimmerman). 1♂, 1♀, Lake Tahoe, Aug. 21 & 22, 1916. 2♀, Los Angeles. 1♂, Oreville, June 24, 1927, (H. H. Keifer). 1♀, Peppermint Mdw., Tulare County, June 30, 1935, (Evans). 1♂, Petrified Forest, July 10, 1926, (Cockerell). 1♀, Yosemite, July 20, 1905, (J. McFarland). 1♂, 4♀, Yosemite Valley, June 24, 27, 1926, (Timberlake, on *Lotus nevadensis* and *Lupinus longipes*). 11♂, 4♀, Pine Valley, San Diego County, Aug. 1♂, Warner's, San Diego Co., Aug. 6, 1921.

OREGON: 1♂, Gold Hill, July 2, 1925; 1♂, Oregon Mt., Josephine County, July 5, 1925; 3♂, 1♀, Hereford, 3660 ft., Aug. 10, 1929, (on *Melilotus alba*); (all Scullen).

WASHINGTON: 2♂, 1♀, Wallawalla, June 1936, (G. E. Bohart).

Specimens of *angelarum* have been identified also from the Huachuca Mts., Arizona.

*Flower records.—Aster* sp., *Cordylanthus rigidus*, *Encelia* sp., *Eriogonum Wrightii*, *Lotus nevadensis*, *L. scoparius*, *Lupinus longipes*, *Melilotus alba*, Palo Verde, *Pentstemon* sp., *Phacelia ramosissima*, Queen Ann's Lace, *Rudbeckia Californica*, *Verbena prostrata* and *Vetix* sp.

**Megachile (Chelostomoides) campanulae** Robertson
(Pls. XXVI, XXVII, XXVIII.)

*Oligotropus campanulae* Robertson, Trans. Am. Ent. Soc., xxix, p. 171, 1903.

*Megachile campanulae* Cockerell, Entomologist, xli, p. 292, 1908.

*Female.*—Size: Length 10-11 mm.; breadth of abdomen 2.7 mm.; anterior wing 7 mm.

Structure: Clypeus flat, apical margin with a shallow median quadrangular emargination delimited by two rather strong tubercles, a smaller tubercle just laterad of each of these; mandible broad apically, 4-dentate; vertex rounded; lateral ocelli slightly nearer eyes than to edge of vertex; second to fourth abdominal terga with distinct basal grooves; but the apical margins depressed only laterally.

Puncturation: Rather coarse and deep in general, close on face, clypeus, and over most of thorax, more widely separated on vertex, cheeks below, and on second to fourth abdominal terga, fine and close on the first and sixth, coarser but close on the fifth.

Color: Black; antennae and tegulae piceous; wings lightly infuscated, somewhat more deeply so apically; spurs yellow.

Pubescence: White and inconspicuous in general, with no black hairs visible on any of the abdominal terga, the basal grooves of the second to the fourth thinly white-fasciate, and these terga with narrow white apical fasciae, widely interrupted on the basal terga, definitely lacking on the fifth; scopa yellowish-white, brownish on sixth sternum.

*Male.*—Size: Length 8-9 mm.; breadth of abdomen 2.5 mm.; anterior wing 6.5 mm.

Structure: Clypeal margin with two small rather widely separated denticles; mandible 3-dentate, with a median triangular inferior projection; vertex rounded; lateral ocelli subequally distant from eyes and edge of vertex; coxal spines reduced to minute denticles; basal joints of front tarsi slightly dilated and flattened, the first joint as long as the following two combined; second to fourth abdominal terga quite deeply grooved basally, distinctly depressed apically for entire width; carina of sixth tergum very low, with a shallow median emargination.

Sternites: Fourth sternum exposed but unmodified; lateral portions of fifth presternite much longer than broad, median portion linear, the medasternite broad, shorter medially than laterally, with sparse minute setae, the poststernal strip broadly and deeply incurved medially; lateral portions of sixth presternite about as broad as long, the medasternal areas oblique, rather widely separated, more extensive toward the inner end, very finely setose, the poststernal lobe very broad and extensive.

Genital armature: Stipites narrowed above base, slightly dilated and more or less obliquely compressed, to the rounded tips; sagittae shorter and less robust than stipites; volsellae robust, broad but quite deeply incised apically.

Puncturation: Deep but rather fine and close in general, very fine and crowded on clypeus, face and cheeks, more coarse and distinct on vertex and thorax, very fine and close on abdomen basally and apically, more distinctly separated on the median terga where the punctures are quite coarse laterally.

Color: Black throughout, including front tarsi, but the antennae obscurely reddish beneath; wings lightly infuscated; tegulae dark ferruginous; spurs pale yellow.

Pubescence: Thin and white in general, with no conspicuous dark hairs; second to sixth abdominal terga with conspicuous and entire dense white basal fasciae, fasciate apically only at extreme sides.

*Type.*—Male; Carlinville, Illinois, July 30, 1888, (Robertson, *Campanula americana*), [Robertson No. 8320].

*Range.*—New England States to Georgia, west to Texas and Nebraska, June to September. Definite records are as follows:

CONNECTICUT: 1♂, Hartford, July 17, 1896. Ident. from Hamden.

DELAWARE: 1♀, no locality record.

GEORGIA: 3♂, no locality record. Ident. from Macon.

ILLINOIS: 1♀, no locality record.

INDIANA: 1♂, no locality record. 1♂, Greenfield, June 29, 1935, (Amick). Identified from Lafayette and Mineral Springs.

MARYLAND: 1♀, Chestertown, Aug. 17, 1899, (E. G. Vanatta).

MASSACHUSETTS: 1♂, 2♀, Forest Hills; 1♂, Forest Hills, July 22, 1926, (on *Baptisia*); 3♀, Needham, Sep. 3, 1927; 4♀, Needham, Aug. 13, 1936, (on *Baptisia*); (all Mitchell). Identified also from Lexington.

NEBRASKA: 1♂, 2♀, Carns, July 16, 1902. 2♀, Omaha, Aug. 9, 1913; (both on *Campanula rotundifolia*). Identified from Childs Point and Nebraska City.

NEW JERSEY: 1♂, Ocean Grove, July 17, 1893.

NEW YORK: 1♂, 1♀, no locality record. Identified from Fishers and Nyack.

NORTH CAROLINA: 1♂, no locality record; 1♀, Horse Cove, Highlands, July 25, 1925; 1♂, Lake Toxaway, July 21, 1922, (on *Baptisia*); 4♀, Marion, Aug. 23, 1930; 2♂, 1♀, Marion, July 25, 1936; 1♂, Willard, June 22, 1929; 1♀, Wilmington, Aug. 2, 1921; (all Mitchell).

Specimens of *campanulae* have been identified from the following additional localities: Colorado—Colorado Springs; Iowa; Kansas—Baldwin; Louisiana; Ohio—Marietta, Put-in-Bay and Smithfield; Pennsylvania—Philadelphia; Texas—Lee Co. & Willis; Virginia—Falls Church, Great Falls and Norfolk; and West Virginia—Monongalia County.

*Flower records.*—*Campanula rotundifolia, Malva sylvestris, Baptisia tinctoria, Galactia* sp.

**Megachile (Chelostomoides) campanulae** var. **wilmingtoni** Mitchell

*Oligotropus wilmingtoni* Mitchell, Journ. Elisha Mitch. Soc., XL, p. 156, 1924.

This was originally considered to be distinct from *campanulae* but the study of additional material of *campanulae* has modified this view. There are no structural differences which have so far been discovered which will satisfactorily separate the two, and intermediate conditions even in color of pubescence have been observed. It may be distinguished in both sexes from the more typical specimens of *campanulae* by the larger size (11-12 mm.), the more deeply infuscated wings and the presence of dark pubescence on the sixth tergum.

*Type.*—Female; Wilmington, North Carolina, August 2, 1921, (Mitchell, on *Strophostyles*), [U.S.N.M., no. 28351].

*Allotype.*—*Topotypical,* August 21, 1921, (*Strophostyles*), [U.S.N.M.].

*Range.*—Available records include only two localities, one in North Carolina and the other in Florida. It probably extends both north from Carolina and westward along the Gulf from Florida. Definite records are as follows:

FLORIDA: 1♂, Crescent City, Apr. 24, 1908, (Van Duzee).

NORTH CAROLINA: 4♂, 4♀, Wilmington, Aug. 2-11, 1921 and 1924, (Mitchell, on *Strophostyles* and *Galactia*).

*Flower records.*—*Galactia* sp., *Strophostyles* sp.

**Megachile (Chelostomoides) exilis** Cresson
(Pls. XXVI, XXVII, XXVIII.)

*Megachile exilis* Cresson, Trans. Am. Ent. Soc., IV, p. 265. 1872. Robertson, Trans. Acad. St. Louis, VIII, p. 48, 1898. Cockerell, Denison Univ. Bull. XI, p. 65, 1898. Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 9, 1900. Cockerell, Entomologist, XLI, p. 292, 1908. Friese, Das Tierr. Lfg. 28, Apidae I, p. 236, 1911. Cresson, Mem. Am. Ent. Soc., I, p. 118, 1916.

*Megachile studiosa* Cresson, Trans. Am. Ent. Soc., IV, p. 269, 1872. Cresson, Mem. Am. Ent. Soc., I, p. 131, 1916.

*Female.*—Size: Length 9-10 mm.; breadth of abdomen 2.5 mm.; anterior wing 7 mm.

Structure: Clypeus flat, apical margin with a broad shallow median emargination which has a slight median denticle; mandible broad apically, 4-dentate; vertex rounded; lateral ocelli subequally distant from eyes and edge of vertex; basal grooves of abdomen distinct.

Puncturation: Close, deep and rather coarse on head and thorax, finer on cheeks, fine and close on basal and apical abdominal segments, more coarse and sparse on the median terga.

Color: Black; antennae and tegulae piceous; wings subhyaline, slightly clouded apically, the nervures piceous; spurs yellow.

Pubescence· Thin short and largely white, blackish on apical abdominal terga, the first to the fifth with entire white apical fasciae, basal grooves of the second to fourth subfasciate; scopa white, dark on apex of sixth sternum.

*Male.*—Size: Length 7-8 mm.; breadth of abdomen 2 mm.; anterior wing 6 mm.

Structure: Mandible 3-dentate, with a triangular submedian inferior projection; vertex rounded; lateral ocelli slightly nearer eyes than to edge of vertex; coxal spines entirely lacking; first to third joints of front tarsus dilated and flattened, the second rectangular and broader than the tibia, the third narrower and narrowed apically, the first about equalling the other two in length; basal grooves of abdomen quite deep and distinct; carina of sixth tergum directed ventrally, very low, with a rounded but rather shallow median emargination.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite much longer than broad, subtriangular, median portion linear, the medasternite much modified, broad, shortened medially by the deeply incurved apical margin, bare except for a short oblique line of setae on each side of the center, the apical margin with a rather short dense fringe on each side of the median emarginate area, and a long posteriorly directed pencil of setae on each extreme side, the poststernal strip somewhat expanded laterally, but largely hidden under the apical margin of the medasternite; lateral portions of sixth presternite quite broad, each with a rounded minutely pubescent area apically, the medasternal areas slightly separated medially, almost devoid of setae, being chiefly recognizable by the pigmentation, broader at inner end, with a transverse carinate line terminating at a lateral posteriorly directed and compact patch of setae, the poststernal lobe broad and extensive.

Genital armature: Stipites much narrowed above base, slender and slightly curved to the tip; sagittae shorter, but slightly more robust than the stipites, at least apically; volsellae robust, irregularly rounded or subtriangular apically.

Puncturation: Crowded, deep and relatively fine on head and thorax, being more distinctly separated on vertex and on pleura below; fine and close on basal and apical abdominal terga, more distinctly separated on the shining median terga.

Color: Black; antennae beneath, tegulae and front tarsi ferruginous; wings subhyaline, faintly clouded apically, the nervures dark; apical margins of abdominal terga yellowish-hyaline; spurs yellow.

Pubescence: Thin and white throughout, more dense on clypeus, front coxae, mesosternum, and venter of abdomen; second to sixth abdominal terga with conspicuous white basal fasciae, the apical fasciae evident only laterally on the more basal segments.

*Type.*—Male; Texas, [A.N.S.P., No. 2349].

*Range.*—The typical form is southwestern in distribution, with the records chiefly from west Texas to Arizona, as follows:

ARIZONA: 1♂, Oak Creek Canyon, July. Identified also from Sabino Basin, Santa Catalina Mts.

NEW MEXICO: 1♂, N. F. Gila, July, 1916.

TEXAS: 6♂, 6♀, no locality record. 1♂, Austin. 11♂, 3♀, Bexar County, Apr. 15 to Sep. 19, (Parks). 1♂, Victoria, Apr. 17, 1904. Identified also from Brownsville, Helotes, Kerrville, New Braunfels, Sabinal and Willis.

*Flower records.*—*Baptisia tinctoria*, *Coreopsis* sp., *Lespedeza repens*, *Polygola* sp., and *Tephrosia virginiana*.

**Megachile (Chelostomoides) exilis** var. **parexilis** new variety
(Pl. XXVI.)

This name is proposed for the eastern form of *exilis* in which the male differs slightly from the western form in having the third joint of the front tarsus nearly as wide as the second joint. In the typical form this joint is narrowed apically. No other differences have been found in either sex, but in this one character the difference seems to be distinct, with intergrading forms so far seen.

*Type.*—Male; Judson, North Carolina, July 19, 1923, (Mitchell, on *Baptisia*), [A.N.S.P., No. 4165].

*Paratypes.*—1♂, Rome, Georgia, Aug. 8, 1934; 1♂, Aberdeen, North Carolina, May 29, 1922, (on *Tephrosia*); 1♂, Harnett County, North Carolina, June 5, 1931; 1♂, Lakeview, North Carolina, Sep. 23, 1933; 3♂, Pilot Mountain, North Carolina, July 19, 1931; 1♂, Raleigh, North Carolina, May 19, 1927, (on *Tephrosia*); (all Mitchell), [all Mitchell]. 1♂, Chestertown, Maryland, July 3, 1906, (E. G. Vanatta). 2♂, Texas; [both A.N.S.P.].

Because of the lack of differences in the other sex of these varieties, no females have been included in the paratype series. Definite records of females which evidently or probably belong with *parexilis* are as follows:

GEORGIA: 1♀, Rome, Aug. 8, 1934, (Mitchell). Identified also from Augusta and Roswell.

NORTH CAROLINA: 3♀, no locality record. 2♀, Aberdeen, June 28, 1930. 1♀, Acme, May 20, 1934, (on *Baptisia*). 1♀, Goldsboro, June 20, 1929, (on *Baptisia*). 1♀, Greensboro, Aug. 30, 1921. 3♀, Harnett County, June 5, 1931, 1♀, Hoffman, July 4, 1928. 3♀, Kingsboro, June 9, 1932, (on *Trifolium*). 2♀, Lakeview, Sep. 5 & 23. 1♀, Marion, July 25, 1936. 2♀, Merry Oaks, May 27, 1926, (on *Tephrosia*). 1♀, Moore County, Sep. 10, 1931. 1♀, Pilot Mountain, July 19, 1931. 2♂, 14♀, Raleigh, Apr. 21 to May 30, (4 on *Tephrosia*). 1♀, Southern Pines, May 29, 1922, (on *Tephrosia*). 1♀, Tarheel, July 22, 1928, (on *Galactia*). 2♀, Willard, June 27, 1929; (all Mitchell).

VIRGINIA: 1♀, Sep. 19, 1880, (no locality given). Identified from Falls Church, Glen Carlyn and Great Falls.

Specimens identified from the following localities should probably be referred to *parexilis*: Alabama—Birmingham; Arkansas—Marion County; Indiana—Vincennes; and Texas—Calhoun County, Fedor, Galveston, Lee County, Range and Willis.

**Megachile (Chelostomoides) subexilis** Cockerell
(Pls. XXVI, XXVII, XXVIII.)

*Megachile subexilis* Cockerell, Entomologist, XLI, p. 292, 1908. Cockerell, Ann. Mag. Nat. Hist., (8), XIII, p. 431, 1914.
*Megachile semiexilis* Cockerell, Entomologist, XLI, p. 292, 1908.

The form described under the name *semiexilis* appears to lie within the range of individual variation of this species, and has therefore been made a synonym.

*Female.*—Size: Length 10-11 mm.; breadth of abdomen 3 mm.; anterior wing 7-7.5 mm.

Structure: Clypeus flat, the apical margin with two prominent median tubercles, and at each extreme side a large triangular tubercle, resulting in a deep but relatively narrow median emargination, and on each side an equally deep but broader emargination; mandible broad apically, 4-dentate; lateral ocelli subequally distant from eyes and edge of vertex; basal grooves of abdominal terga distinct and fasciate.

Puncturation: Coarse, close and deep on clypeus; more distinctly separated and finer on vertex and thorax above, but crowded on pleura above; fine and close on second to fourth abdominal terga, but rather coarse and more close on the fifth.

Color: Black; antennae beneath and tegulae obscurely reddish to piceous; wings subhyaline; spurs yellow.

Pubescence: Whitish or creamy, very short on abdomen, somewhat longer on head and thorax; no definitely dark pubescence evident on either the vertex, dorsum of thorax, or abdomen; second to fourth abdominal terga with inconspicuous basal white fasciae, the first to the fifth with dense and conspicuous white or creamy apical fasciae, the sixth with suberect whitish pubescence, with intermixed inconspicuous darker hairs; scopa white, dark on the sixth sternum apically.

*Male.*—Size: Length 8-9 mm.; breadth of abdomen 2.3 mm.; anterior wing 6 mm.

Structure: Clypeal margin with a median emargination delimited by two prominent tubercles; mandible 3-dentate, with a large submedian triangular projection; lateral ocelli slightly nearer edge of vertex than to eyes; coxal spines much reduced, tubercle-like but prominent; first and second joints of front tarsi dilated almost to the width of their tibiae, flattened, the lower surface slightly concave, the first about twice the length of the second, the third only slightly dilated; basal grooves of abdominal terga deep and conspicuously fasciate, the apical margins of the terga quite strongly depressed; carina of the sixth tergum very low and inconspicuous, with a shallow but definite rounded median emargination.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite much longer than broad, median portion linear and somewhat angular, the medasternite broad, shorter medially than laterally, with very sparse and fine setae, the poststernal strip broadly and deeply incurved medially; lateral portions of sixth presternite broader than long, slightly pubescent apically, the medasternal areas straight, linear laterally, more extensive at inner end, slightly separated, quite densely and finely pubescent, especially at inner end, the poststernal lobe broad and extensive, rounded laterally, truncate apically.

Genital armature: Stipites narrowed above base, gradually dilated to the robust oblique and rounded tips; sagittae less robust and considerably shorter than stipites; volsellae robust, quite broad and slightly incised apically.

Puncturation: Moderately coarse and deep in general; close on face, pleura above, mesonotum, scutellum, and first and fifth abdominal terga; more definitely separated on vertex, pleura below, and on the median abdominal terga; very fine and close on cheeks and on the sixth tergum, crowded on the latter.

Color: Black; antennae beneath and front tarsi obscurely reddened; tegulae more definitely ferruginous; legs dark throughout; wings subhyaline; apical margins of second to fourth abdominal terga yellowish-hyaline; spurs yellow.

Pubescence: Whitish in general, very short on abdomen, longer and more dense on head and thorax, with no definitely dark pubescence visible; second to sixth abdominal terga with dense and entire white basal fasciae, the apical fasciae evident only at the extreme sides of the more basal segments.

*Type.*—Female; Boulder, Colorado, August 4, 1908, (S. A. Rohwer), [U.S.N.M., no. 12206].

*Range.*—Arizona, New Mexico, Utah, Colorado, and Nebraska, June, July and August. Definite records are as follows:

ARIZONA: 3♀, S. Arizona, Aug. 1902, (Snow). 1♂, Cochise County, June 26, 1916 (V. W. Owens). 1♀, Turkey Creek Canyon, Chiracachua Mts., 6000 ft. Identified also from Bear Wallow, Cave Creek Canyon, Mt. Lemar, Santa Catalina Mts., and Santa Rita Mts.

COLORADO: 3♂, 1♀, no locality record. 2♂, 4♀, Boulder, Aug. 1, 1908, (S. A. Rohwer), June 9 to July 28, 1925, (C. P. Custer), June 16, 1932, (Hicks). 14♂, 19♀, Boulder County, May 26 to Aug. 22, 1925 & 1926, (Custer and Hicks). 4♂, 1♀, Boulder, July 6 to Aug. 14, 1935, (Michener, on *Helianthus, Opuntia* and *Psoralea tenuiflora*). 1♀, Denver, July 11, 1897, (on alfalfa). 1♂, 2♀, Glenwood Springs, Aug. 5, 1920. 1♀, Granite Peaks Camp, Bayfield, 9000 ft., July 18, 1928, (Bequeart). Identified also from Fort Garland and foot of Pikes Peak.

NEVADA: 1♂, no locality record.

NEW MEXICO: 1♂, Bailey Canyon, Aug. 10, (T. D. A. and W. P. Cockerell). 1♂, N. F. Gila (north fork Gila river?), July 12, (labeled *Megachile exilis* cer.). 2♂, Highrolls, June 12 and 13, 1902.

UTAH: 1♂, 1♀, Ogden, July 25, 1920. Identified also from Huntsville and Provo.

Specimens of *subexilis* have been identified also from California and from Glen, Sioux County, Nebraska.

*Flower records.*—*Helianthus* sp., *Opuntia* sp., *Psoralea tenuiflora* and *Medicago sativa.*

**Megachile (Chelostomoides) georgica** Cresson
(Pls. XXVI, XXVII, XXIX.)

*Megachile georgica* Cresson, Trans. Am. Ent. Soc., VII, p. 123, 1878. Friese, Das Tierr., Lfg. 28, Apidae 1, p. 238, 1911. Cresson, Mem. Am. Ent. Soc., 1, p. 119, 1916. Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162, 1930.

*Gnathodon georgicus* Robertson, Trans. Am. Ent. Soc., XXIX, p. 172, 1903.

*Megachile penicillata* Cockerell, Ann. Mag. Nat. Hist., (8), XV, p. 536, 1915.

*Female.*—Size: Length 12–13 mm.; breadth of abdomen 3 mm.; anterior wing 8 mm.

Structure: Clypeus flat, apical margin entire; mandible broad apically, 4-dentate; cheeks narrower than eyes; lateral ocelli somewhat nearer eyes than to edge of vertex; second to fourth abdominal terga with deep basal grooves, the third and fourth also definitely depressed apically across entire width, the apical margins of the more basal terga depressed only laterally.

Puncturation: Close, deep and rather coarse on head and thorax, crowded on clypeus and face; scattered and rather fine on abdominal terga, but more close on the apical segments.

Color. Black; antennae very obscurely reddish beneath; tegulae dark ferruginous; spurs yellow; wings lightly infuscated, slightly darker apically, the nervures piceous or black.

Pubescence: White and rather short in general, longer below, short and blackish on vertex, mesonotum and fifth and sixth abdominal terga, the first to the fourth with white apical fasciae, entire and conspicuous on the fourth, very thin medially on the third, and widely interrupted on the first and second; basal grooves only subfasciate; sixth tergum with some white tomentum toward base; scopa white, black on the sixth sternum.

*Male.*—Size: Length 10-11 mm.; breadth of abdomen 3 mm.; anterior wing 8 mm.

Structure: Mandible with a relatively small subapical inferior projection; vertex rounded; lateral ocelli, slightly nearer eyes than to edge of vertex; basal joints of front tarsi dilated and flattened, the metatarsus much longer than any of the other joints; coxal spines definite but rather short; basal grooves of abdominal terga quite deep, apical margins of the second to fourth depressed; carina of sixth tergum low, with a rather shallow semicircular median emargination.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite much longer than broad, short linear medially, the medasternite very extensive but largely bare, the simple and rather fine setae confined to the two sides of a median non-setose line and to the apical margin, being well distributed over the intervening angle, a small area of long pubescence at each extreme side apically; lateral portions of sixth presternite much longer than broad, the medasternal areas extensive, separated medially by an obscure non-setose line, quite uniformly covered with moderately robust and apically flexed setae, the poststernal lobe extensive.

Genital armature: Basal portion of stipites relatively restricted, abruptly narrowed above base, very slightly dilated toward the obliquely flexed and robust tips, inner surface just above base with a few scattered hairs; sagittae straight, robust, the tips slightly dilated, the base protuberant dorsally; volsellae moderately robust, triangularly acute apically.

Puncturation: Deep but moderately coarse and close throughout, more coarse on clypeus, pleura and abdominal terga, quite close on dorsum of thorax and on basal and apical abdominal terga.

Color: Black; antennae obscurely reddish beneath; tegulae dark ferruginous; front tarsi pale ferruginous; spurs yellow; wings lightly infuscated, slightly darker apically, the nervures piceous; apical margins of second to fourth abdominal terga yellowish-hyaline.

Pubescence: White in general, thin above, longer and more dense below, with very short and obscure blackish pubescence on vertex, dorsum of thorax, and apical abdominal segments; terga with conspicuous white basal fasciae, the apical margins fasciate only laterally.

*Type.*—Female; Georgia, [A.N.S.P., no. 2415].

*Range.*—Maryland to Florida, west to Texas, April to September. Definite records are as follows:

GEORGIA: 1♀, Rome, Sep. 2, 1930, (Mitchell).

NORTH CAROLINA: 2♂, no locality record; 1♀, Acme, May 20, 1934, (on *Baptisia*); 2♂, 4♀, Carolina Beach, Aug. 10, 1922 & June 12, 1930; 1♀, Harnett County, Sep. 30, 1933. 3♀, Merry Oaks, May 27, 1926, (on *Tephrosia*); 1♂, 7♀, Raleigh, May 19 to Aug. 30, (on *Pentstemon, Strophostyles* and *Tephrosia*); 1♂, Rocky Mount, June 15, 1934. 5♀, Southport, June 23, 1928, (on *Hypericum*); 1♂, White Lake, May 20, 1934; 1♀, Willard, June 22, 1929; 1♂, 8♀, Wilmington, June 23 to Sep. 12, (on *Clethra, Galactia,* and *Hypericum*); (all Mitchell).

SOUTH CAROLINA: 1♂, 3♀, Georgetown, Aug. 1, 1934, (Mitchell).

TEXAS: 1♀, no locality record. Recorded from Willis.

Specimens of *georgica* have been identified also from the following localities: Alabama—Cowarts; Arkansas—Marion County; Florida—Hollywood, Miami, No Name Key and Titusville; Maryland; and Virginia—Falls Church.

*Flower records.*—*Afzelia cassinoides, Baptisia tinctoria, Lobelia* sp., *Pentstemon* sp., *Pycnanthemum hypsopifolia, Tephrosia virginiana, Clethra alnifolia, Galactia* sp., *Hypericum* sp., *Strophostyles* sp.

**Megachile (Chelostomoides) occidentalis** Fox
(Pls. XXVI, XXVII, XXIX.)

*Megachile occidentalis* Fox, Proc. Calif. Ac. Sc., IV, p. 117, 1894. Cockerell, Denison Univ. Bull., XI, p. 65, 1898. Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 9, 1900. Cockerell. Can. Ent., XXXV, p. 215, 1903. Friese, Das Tierr., Lfg. 28, Apidae I, p. 242, 1911. Cockerell, Ann. Mag. Nat. Hist., (8), XV, p. 536, 1915. Cockerell, Proc. Calif. Ac. Sc., (4), XII, p. 546, 1924.

*Megachile prosopidis* Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 16, 1900. Cockerell, So. Calif. Ac. Sc. Bull., I, p. 71, 1902. Cockerell, Proc. Calif. Ac. Sc., (4), XII, p. 546, 1924.

*Megachile prosopidis* var. *testudinis* Cockerell, Proc. Calif. Ac., Sc., (4), XII, p. 550, 1924.

It seems evident now that *prosopidis* is the female of *occidentalis*, and the two are thus considered under the one name here.

The female specimens at hand agree more nearly with the description of var. *testudinis* than with typical *prosopidis*.

Cockerell states in his key (1924) that *prosopidis* has the median process of the clypeus bifid, and separates var. *testudinis* from it by the entire and more or less pointed median clypeal process and the darker tegulae. The type of *prosopidis* does not appear to have a markedly different clypeus from those at hand, however, and the median clypeal process does not seem to be " bifid ". Cockerell further states that the difference is perhaps one of individual rather than subspecific variation, and it seems hardly necessary therefore to distinguish clearly between the two forms.

*Female*.—Size: Length 14-15 mm.; breadth of abdomen 3.5-4 mm.; anterior wing 9 mm.

Structure: Face slightly broader than long; clypeal margin angulate medially, deeply emarginate on each side of middle, with robust and relatively acute tubercles laterad of these; mandible definitely 5-dentate; distance between lateral ocelli and edge of vertex about twice that between eyes and lateral ocelli; basal joint of flagellum shorter than pedicel, the second joint subequal to the pedicel, middle joints nearly twice as long as broad; cheeks somewhat broader than eyes; vertex convex; all the metatarsi shorter and narrower than their tibiae; second to fourth abdominal terga with deep basal grooves, their apical margins depressed, deeply so toward the sides, as also the fifth, the dorsal surface of the sixth nearly vertical, with the apical lip not abrupt.

Puncturation: Fine and close between antennae and ocelli, and on upper cheeks; slightly more coarse but close on cheeks below, and on mesonotum and pleura, more sparse on scutellum and vertex; close and rather coarse on clypeus except medially; fine and close on propodeum; minute on tegulae; close and fine on basal and apical abdominal segments, more coarse and sparse on the median terga medially, becoming close laterally.

Color: Black; antennae reddish beneath; legs reddish to piceous; spurs yellow, tegulae bronzy-ferruginous; wings hyaline, slightly clouded apically, the nervures piceous.

Pubescence: Mostly white, dense around antennae and on inner orbits, around pronotal tubercles and lateral margins of mesonotum, long on cheeks below, on pleura, propodeum and basal abdominal segment; very short and obscurely brownish on vertex and mesonotum; black on fifth abdominal tergum, which is also black-fringed apically, the sixth with some short fine white pubescence basally, short and black laterally and apically; first to fourth terga with entire dense white apical fasciae; scopa white, blackish on sixth sternum.

*Male.*—Size: Length 13-14 mm.; breadth of abdomen 3.5 mm.; anterior wing 9 mm.

Structure: Clypeal margin somewhat produced medially, the production broadly emarginate; mandible 3-dentate, with a triangular subapical inferior projection; coxal spines robust but very short and blunt; first and second joints of front tarsi dilated and flattened, the basal joint slightly shorter than the apical one: basal grooves of abdominal terga quite pronounced, the apical margins of the median terga strongly depressed, carina of sixth tergum low and inconspicuous, with a rounded median emargination.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite extensive, triangular, median portion short linear, the medasternite broadly triangular in outline, with a median non-setose area on each side of which is a subtriangular area densely covered with long robust curved medially directed setae, the poststernal strip inevident; lateral portions of sixth presternite considerably longer than broad, the medasternal areas extensive, especially medially where they are slightly separated by a non-setose line, otherwise uniformly beset with setae which are abruptly flexed apically, those toward the apical margin robust, the poststernal lobe very broad but rather short.

Genital armature: Stipites much narrowed above base, gradually dilated to the broadly expanded and obliquely truncate tips; sagittae straight and robust, exceeding the inner margin of the truncation of the stipites, but not quite equalling their tips, somewhat protuberant dorsally at base; volsellae short but robust, broadly and obliquely truncate apically.

Puncturation: Fine and rather close on head; closer and somewhat coarse on thorax; relatively coarse but rather close on abdomen, densely crowded on the apical terga.

Color: Black; antennae, tegulae and apical leg joints ferruginous; wings subhyaline, rather distinctly clouded apically; spurs yellow; apical margins of median abdominal terga yellowish-hyaline.

Pubescence: Whitish in general, rather dense on face, clypeus, cheeks below, pleura and sternum of thorax, and venter of abdomen; some short dark hairs on vertex, mesonotum, and on apical abdominal terga; second to sixth terga with conspicuous white basal fasciae, the apical fasciae evident only laterally on the basal segment.

*Type.*—Male; San Ignacio, Lower California, April, (Haines), [Calif. Ac. Sc.].

*Range.*—Southern California, Arizona, New Mexico, and Texas, May and August. Definite records are as follows:

ARIZONA: 1♂, 8♀, Yuma, May 4, 1918, (Bradley).

CALIFORNIA: 2♂, 1♀, Palm Springs, May 11, 1935. 1♂, five miles north of Indio, Apr. 10; (all Michener, on *Cercidium Torreyanum*).

MEXICO: 1♀, Guaymas, Apr. 8, 1921, (E. P. Van Duzee). 1♀, Los Mochis, Sinaloa, Aug. 1, 1922, (C. T. Dodds).

NEW MEXICO: 3♂, 5♀, Alamogordo, Apr. 29 to June 3, 1902. 2♂, 1♀, Highrolls, June 10 & 12, 1902. 1♂, Mesilla, Apr. 22, (Cockerell, on *Phacelia*). 1♀, "Mlla" (Mesilla?), May 10, 1895, (J. E., on Mesquite). [Type of *prosopidis*, U.S.N.M., no. 5163].

Specimens of *occidentalis* have been identified also from Los Angeles County, California and from Valentine, Texas.

*Flower records.—Phacelia* sp. and *Cercidium Torreyanum.*

**Megachile (Chelostomoides) davidsoni** Cockerell
(Pls. XXVI, XXVII, XXIX.)

*Megachile davidsoni* Cockerell, So. Calif. Ac. Sc., Bull., I, p. 70, 1902. Crawford, Proc. U.S.N.M., XLVIII, p. 578, 1915.

*Megachile occidentalis* var. *leucotricha* Cockerell, Calif. Ac. Sc., Bull., I, p. 137, 1902.

*Female.*—Size: Length 14-16 mm.; breadth of abdomen 4 mm.; anterior wing 10 mm.

Structure: Clypeus projecting at right angles to face as two conspicuous triangular protuberances; mandible elongate, inconspicuously 4-dentate, the base above produced into a long upward projecting protuberance; labrum elongate, with a median protuberance near the tip; vertex rounded; lateral ocelli considerably nearer eyes than to edge of vertex; cheeks much broader than eyes; second to fourth abdominal terga with distinct basal grooves.

Puncturation: Fine on head, close on face and on cheeks above, quite sparse on vertex, the clypeal protuberances with only a few scattered coarse punctures; more coarse on thorax than on head, close and deep for the most part; rather close and fine on the basal and apical abdominal terga, but coarse and scattered on the more median terga, quite close on the fifth.

Color: Dark throughout, with yellow spurs and subhyaline wings.

Pubescence: Whitish in general, but fuscous and inconspicuous on vertex and dorsum of thorax, the apical abdominal terga with short erect black hairs; first to fourth terga with entire white apical fasciae, the basal grooves but very thinly fasciate, the fifth with an apical fringe of short black hairs, and the sixth with white tomentum basally, brown tomentum apically; scopa yellowish-white, black on the sixth sternum.

*Male.*—Size: Length 13-14 mm.; breadth of abdomen 3.5 mm.; anterior wing 9 mm.

Structure: Clypeus somewhat produced medially, with a shallow median emargination; mandible 3-dentate, with a rather narrow median inferior projection; cheeks wider than eyes; lateral ocelli slightly nearer eyes than to edge of vertex; coxal spines very short and blunt; first and second joints of front tarsi dilated slightly, much flattened, the apical joints much longer than the basal ones; second to fourth abdominal terga with deep basal grooves; carina of sixth tergum rather low, with a semicircular median emargination.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite extensive, slightly longer than broad, median portion short linear, the medasternite subtriangular, with a median non-setose area on each side of which is a triangular area densely covered with robust curved medially directed setae (these shorter than in *occidentalis*), the poststernal strip inevident; lateral portions of sixth presternite slightly longer than broad, the medasternal areas extensive, slightly separated medially, each one subtriangular and uniformly covered with setae which are abruptly flexed apically, those toward the apical margin robust, the poststernal lobe very broad and short.

Genital armature: Stipites much narrowed above base, gradually dilated to the broadly expanded and obliquely truncate tips; sagittae robust, length about equalling the outer angle of the truncate tips of the stipites, protuberant at base dorsally; volsellae short but robust, subtruncate or broadly rounded apically.

Puncturation: Rather fine and quite dense on thorax throughout, as also on cheeks, face, clypeus laterally, and on basal and apical abdominal segments; rather sparse and fine on vertex; coarse and quite close on median abdominal terga; clypeus with a rather broad definitely delimited median impunctate area.

Color: Black; antennae beneath, tegulae and front metatarsi ferruginous; spurs yellow; wings subhyaline.

Pubescence: White and rather long and dense on head, thorax and basal abdominal segments; blackish on fourth to sixth terga, the second to the sixth with conspicuous white basal fasciae, the apical fasciae evident only laterally.

*Type.*—Female; Southern California, (Dr. A. Davidson), [Cockerell].

*Range.*—Southern California, July. Definite records are as follows:

CALIFORNIA: 2♂, 3♀, Forest Home, San Bernardino County, June 13–18, 1928, (E. C. Van Dyke). 1♂, Los Angeles. 1♂, 1♀, Los Angeles County, June, (Coquillett). 1♂, 3♀, Rim of World, trail from Big Bear dam, July 6, 1934, (Timberlake, on *Dicentra chrysantha*). 2♂, 2♀, San Antonio Canyon, north of Ontario, 5300 ft., June 20, 1931, (Scullen). 1♂, 1♀, San Jacinto Mts., July 14, 1912, (J. C. Bridwell). 1♂, 5♀, San Gabriel Canyon, Los Angeles County, June 25, 1933; 2♂, 9♀, Crystal Lake, San Gabriel Mts., July 7, 1934; (all Michener, on *Dicentra chrysantha*). 3♂, 3♀, Idyllwild, June 26, 1936, (M. Cazier). 4♂, 3♀, Big Bear Lake, San Bernardino County, July 6 & 9, 1934, (Isabel McCracken).

*Flower records.—Dicentra chrysantha.*

**Megachile (Chelostomoides) pratti** Cockerell (Pls. XXVI, XXIX.)

*Chelostomoides pratti* Cockerell, Ann. Mag. Nat. Hist., (8), XI, p. 541, 1913.
*Megachile (Chelostomoides) pratti* Cockerell, Proc. Calif. Acad. Sci., (4), XII, p. 548, 1924.

It seems quite possible if not probable that *pratti* and *discorhina* are the same, since Prof. Timberlake has caught them visiting the same flowers and since there is a similarity in color of pubescence.*

*Male*.—Size: Length 9-10 mm.; breadth of abdomen 3 mm.; anterior wing 6-7 mm.

Structure: Length and breadth of face about equal; eyes subparallel; clypeal margin broadly but slightly produced medially; mandible 3-dentate, without an inferior projection; cheeks narrower than eyes; vertex very slightly convex, hind margin almost straight; lateral ocelli slightly nearer eyes than to each other or to edge of vertex; basal joint of flagellum subequal in length to pedicel, the second joint three times this length, the apical joint neither dilated nor flattened; front coxae with neither spines nor tubercles; front tarsi simple; carina of sixth tergum low, roundly emarginate, consisting of two short triangular projections, the apical margin of the tergum with low carinate median teeth which are nearer the more acute lateral teeth than to each other; seventh tergum visible, its apical margin straight and simple.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite about half as broad as long, median portion long linear, the medasternite broad, more or less membraneous, with robust setae which are broadly dilated and somewhat cup-shaped apically, these more closely set laterally, the median line non-setose, the poststernal strip almost straight; lateral portions of sixth presternite longer than broad, triangularly produced apically, the medasternal areas slightly separated medially, occupied by about four transverse rows of robust flattened setae, the tips of which are slightly dilated and abruptly truncate, the poststernal lobe extensive, about a third as wide apically as the total width of the sternum, very slightly incised medially.

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* It will be noted that in the key to males (p. 385) and in the plates a distinction is made between *pratti* and *discorhina*. The differences between them, however, are very slight and are evidently varietal rather than specific in character. The specimens assigned to *discorhina* differ from typical *pratti* only in the finer puncturation of the scutellum and in the lack of black pubescence on the terminal segments of the abdomen, this being quite conspicuous in *pratti*. No similar division of females into two corresponding groups seems possible, unless it be true that the female of *pratti* yet remains to be discovered.

Genital armature: Stipites slightly narrowed above base, somewhat more robust toward the tips which are slightly flexed laterally and gradually narrowed to the rounded apex; sagittae shorter and more slender than stipites, the tips slightly dilated, widely separated and laterally protuberant at base; volsellae robust, narrowed toward the tips which are slightly incised.

Puncturation: Fine and rather close on head; somewhat coarser but close on mesonotum, scutellum, and on pleura above, becoming still more coarse on pleura below; fine and close on basal and apical abdominal terga, becoming somewhat more coarse and sparse on the median terga.

Color: Black; antennae brownish; tegulae yellowish-ferruginous; wings hyaline, the nervures brownish; legs piceous, becoming ferruginous apically; spurs yellow; apical margins of abdominal terga transparent yellowish-hyaline.

Pubescence: White and rather long on head, thorax and basal abdominal segment, intermixed with long blackish or brownish hairs on clypeus, face, vertex, mesonotum and scutellum; short and blackish on fourth to sixth abdominal terga, the second to the sixth with entire dense white basal fasciae, the first to the third with white apical fasciae evident laterally, the venter of the abdomen with considerable long white pubescence fringing the plates apically.

*Type.*—Male; San Diego, Texas (Jones and Pratt), March 25, 1908. [U.S.N.M., no. 16251].

*Range.*—Arizona, New Mexico and Texas, March, April, May, and June. Definite records are as follows:

ARIZONA: 2♂, Catalina Springs, Apr. 21, (E. A. Schwarz). 1♀, Florence, May 23, 1903. 2♂, Yuma, May 4, 1918, (Bradley).

CALIFORNIA: 1♂, Box Canyon, Apr. 13, 1934, (Timberlake, on *Cercidium Torreyanum*). 1♂, Potholes, Imperial County, Apr. 11, 1923, (E. P. Van Duzee).

MEXICO: 1♂, San Ignacio, Lower California, Apr. 1889, (Haines; labelled *Megachile occidentalis* Fox).

NEW MEXICO: 1♂, Alamogordo, Apr. 10, 1902.

TEXAS: 1♂, San Diego, March 25, 1908, (Jones and Pratt).

*Flower records.*—*Cercidium Torreyanum.*

### **Megachile (Chelostomoides) discorhina** Cockerell (Pls. XXVII, XXVIII.)

*Megachile discorhina* Cockerell, Proc. Calif. Ac. Sc., (4), XII, p. 549, 1924.

*Female.*—Size: Length 11 mm.; breadth of abdomen 2.5 mm.; anterior wing 7 mm.

Structure: Face broader than long; eyes divergent below; clypeus protuberant, strongly arched, the upper face very short, the lower face impunctate and much greater in extent; mandible long and slender, very slightly angled on outer margin, the teeth very inconspicuous; lateral ocelli nearer eyes than to edge of vertex; basal grooves of abdominal terga shallow and inconspicuous; sixth tergum oblique in position rather than vertical, the apical lip not as abrupt as in some forms.

Puncturation: Fine throughout, close on cheeks, pleura, and on basal and apical segments; distinctly separated on the shining face and vertex; more coarse and well separated on dorsum of thorax and on the median abdominal terga.

Color: Black; antennae obscurely reddish beneath; tegulae somewhat bronzy; spurs yellow; wings subhyaline, more clouded apically.

Pubescence: White on head and thorax except for a few inconspicuous dark hairs on dorsum of thorax and some very fine blackish pubescence on abdominal terga; first to fifth terga with entire white apical fasciae, the second and third with the basal grooves subfasciate; scopa white, darkened only at tip of sixth sternum.

*Type.*—Female; Palm Canyon, Angel de la Guarda Island, Gulf of California, May 3, 1921, (E. P. Van Duzee), [Mus. Calif. Ac. Sc., no. 1514].

*Range.*—Southern California, April and May. Definite records are as follows:

CALIFORNIA: 4♀, Box Canyon, Apr. 13, 1934. 1♀, Guachella Valley, near Oasis, Apr. 19, 1925. 1♀, Palm Springs, Apr. 22, 1928, (all Timberlake, on *Cercidium Torreyanum*). 1♀, Palm Springs, Apr. 3, 1925, (Van Dyke). 1♀, Potholes, Imperial County, Apr. 10, 1923, (Van Duzee). 2♀, Palm Canyon, San Diego County, Mar. 29, 1936; 1♂, 1♀, Oasis, Riverside County, Mar. 7, 1936; 1♂, 7♀, Edom, Riverside County, Mar. 28, 1936; 2♂, 2♀, two miles west of Edom, Mar. 8, 1936; (all E. G. Linsley, on *Larrea glutinosa*). 2♀, Palm Springs, Riverside County, Apr. 10, 1936, (on *Cercidium Torreyanum*). 2♀, Andreas Canyon, Palm Springs, Apr. 10, 1936, (on *Prosopis juliflora*) and May 11, 1936, (on *Acacia Greggii*). 1♀, five miles north of Indio, Apr. 10, (on *Cercidium Torreyanum*). 18♀, Cathedral City, Riverside County, Apr. 10, 1936, (on *Cercidium Torreyanum*); (all Michener). 10♀, Dos Palmos, Colorado Desert, Mar. 14, 17 & 19, 1934 and June, 1932, (M. Cazier). 1♀, Edom, Riverside County, Mar. 8, 1936, (F. R. Platt, on *Larrea tridentata*).

*Flower records.*—*Cercidium Torreyanum*, *Larrea glutinosa*, *L. tridentata*, *Prosopis juliflora* and *Acacia Greggii.*

**Megachile (Chelostomoides) felipiana** new species (Pl. XXVII.)

*Female.*—Size: Length 12 mm.; breadth of abdomen 3 mm.; anterior wing 7 mm.

Structure: Face broader than long; eyes slightly divergent below; clypeus modified, its upper margin narrowly protuberant just below bases of antennae, the apical margin with a broad deep rounded median emargination, each lateral piece only slightly broader than the width of the emargination; mandibles long and slender, obscurely 3-dentate apically, and with an obtuse subapical inner angle; basal joint of flagellum much shorter than the second joint, these two combined subequal in length to the pedicel and to the third joint; lateral ocelli slightly nearer eyes than to edge of vertex; vertex rounded; cheeks below subequal in width to eyes; all the metatarsi narrow and slender, shorter than their respective tibiae; second to fourth abdominal terga with deep basal transverse grooves, the sixth more vertical in position, with an abrupt apical shelf-like lip.

Puncturation: Coarse, scattered and shallow on lateral clypeal lobes; finer, but more distinct and deep, definitely separated on shining surface of upper face and vertex; fine and indistinct on cheeks above, coarse and becoming sparse below; coarse, deep and distinct on shining mesonotum and scutellum, more fine and close anteriorly, rather sparse on scutellum; deep and distinct on pleura, fine and close above, more coarse and sparse below; very fine and close on propodeum laterally; close and rather fine on basal segment of abdomen, sparse and rather coarse on the second to the fifth, close and rather fine on the sixth.

Color: Black; mandibles dark ferruginous, antennae and legs somewhat paler ferruginous, tegulae more yellowish-ferruginous; wings hyaline, with fuscous nervures; spurs pale yellow.

Pubescence: Mostly white, dense between lower orbits and antennae, on lower cheeks and around wing bases, very thin on mesonotum, scutellum and abdominal terga; mesonotum with a pair of anterior oblique lines of tomentum, with no dark hairs evident on disc; first to fourth abdominal terga with conspicuous entire white apical fasciae, the fifth not fasciate, the sixth with a basal white tomentose area beyond which the pubescence is thin and darker; scopa white, that on the sixth sternum slightly darkened apically.

*Type.*—Female; San Felipe Valley, San Diego County, California, July 24-28, 1920, [San Diego Mus. Nat. Hist.].

**Megachile (Chelostomoides) lobatifrons** Cockerell
(Pls. XXVI, XXVII, XXVIII.)

*Megachile lobatifrons* Cockerell, Proc. Calif. Ac. Sc., (4), XII, p. 547, 1924.

*Female.*—Size: Length 9 mm.; breadth of abdomen 2.5 mm.; anterior wing 6 mm.

Structure: Clypeus short medially, the apical margin evenly convex, each extreme side strongly lobate; mandible broad apically, inconspicuously 5-dentate, with basal protuberances above and below; basal grooves of abdominal terga rather shallow.

Puncturation: Very fine on head except on clypeus and mandibles; slightly more coarse on thorax, and relatively coarse and sparse on abdomen, but more close and fine on the basal and apical terga.

Color: Black; antennae and legs ferruginous; tegulae more yellowish; spurs piceous; wings subhyaline.

Pubescence: White and thin in general, more dense around antennae, across front of mesonotum, and on pleura and propodeum; very short and dark on vertex, dorsum of thorax, and on abdominal terga; first to fourth terga with entire white apical fasciae, the fifth not fasciate, the sixth with a conspicuous basal patch of white tomentum; scopa yellowish-white, brown on sixth sternum.

*Male*.—Size: Length 8-9 mm.; breadth of abdomen 2.5 mm.; anterior wing 6 mm.

Structure: Clypeal margin subentire, with a shallow median emargination; mandible 3-dentate, without an inferior projection; front coxae not spined; front tarsi slender and simple; carina of sixth tergum quite strongly produced but very narrow, directed ventrally, very slightly emarginate.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite much longer than broad, median portion long linear, the medasternite broad and extensive, largely membraneous, the setae quite robust, directed basally, and confined to an oblique linear area on each side of middle, those toward the inner ends of these areas quite short, those toward the outer ends very long, the poststernal strip broadly incurved; lateral portions of sixth presternite longer than broad, with considerable long pubescence apically, the medasternal areas extensive, with numerous relatively fine setae, slightly separated by a median non-setose area, the poststernal lobe extensive, broad basally but narrowed apically, the margin broadly incurved.

Genital armature· Stipites much compressed above base, the tips slightly flexed laterally, more cylindric with rounded apex; sagittae robust, subequal to stipites in length, strongly bowed with the tips approximate; volsellae robust, the inner apical angle of each slightly protuberant and bearing a few short hairs.

Puncturation: Very minute and sparse on the shining head; slightly coarser and rather close on thorax; relatively close and coarse on abdomen, the fifth tergum being coarsely rugose-punctate, the sixth finely so.

Color: Black; antennae dark ferruginous; tegulae, spurs and legs light ferruginous; wings hyaline.

Pubescence: Dense and white on face, clypeus, cheeks, pleura, sternum, coxae, trochanters and sterna of abdomen; first to fifth abdominal terga with short inconspicuous black pubescence, the first to the fourth with conspicuous white apical fasciae, and the fourth to the sixth with conspicuous white basal fasciae.

*Type.*—Female; Puerto Refugio, Angel de la Guarda Island, Gulf of California, June 29, 1921, (E. P. Van Duzee), [Mus. Calif. Acad. Sci., no. 1512].

*Range.*—Southern California, Arizona and New Mexico, April to June. Definite records are as follows:

ARIZONA: 1♀, no locality record.

CALIFORNIA: 2♀, Box Canyon, Apr. 13, 1934, (Timberlake, on *Olnega tesota*). 1♂, 1♀, Big Pine, Inyo County, June 17, 1929, (R. L. Usinger). 1♂, Bishop, Inyo County, June 21, 1929, (E. P. Van Duzee). 1♀, Jacumba, Aug. 12, 1917, (on *Eriogonum fasciculatum*). 1♂, 1♀, Puerto Refugio, Gulf of California, Angel de la Guarda Island, June 29, 1921, (E. P. Van Duzee). Identified also from Palm Springs.

NEW MEXICO: 1♂, Alamogordo, Apr. 29, 1902.

*Flower records.—Eriogonum fasciculatum, Olnega tesota.*

**Megachile (Chelostomoides) longula** Fox (Pl. XXVII.)

*Lithurgus oblongus* Fox, Proc. Calif. Acad. Sci., IV, p. 20, 1894.
*Megachile chilopsidis* Cockerell, Ann. Mag. Nat. Hist., (7), VI, p. 17, 1900.
*Megachile longula* Fox, Ent. News, XIII, p. 137, 1902. Cockerell, Proc. Calif. Acad. Sci., (4), XII, p. 548, 1924.

*Female.*—Size: Length 11–12 mm.; breadth of abdomen 3.5 mm.; anterior wing 7–8 mm.

Structure: Outer face of clypeus very short and small, the apical margin very thick; mandible long and slender, slightly elbowed, inconspicuously 3-dentate apically; labrum long and broad, with a low submedian basal protuberance; cheeks broader than eyes, the latter converging below; vertex rounded; lateral ocelli much nearer eyes than to edge of vertex; basal grooves of abdominal terga definite but inconspicuous.

Puncturation: Close and fine on cheeks and vertex; outer face of clypeus with a few coarse punctures, the inner face polished and impunctate; rather coarse but quite close on thorax and abdomen, becoming coarser and slightly more sparse on abdomen laterally, very minute and densely crowded on the sixth sternum.

Color: Black; antennae obscurely reddish beneath; legs dark; tegulae bronzy; wings subhyaline; spurs yellow.

Pubescence: Whitish in general, rather dense on sides of face, on cheeks behind and below, and on pleura; some short dark inconspicuous pubescence on vertex, dorsum of thorax, and abdominal terga; mesonotum with a pair of oblique lines of dense white tomentum anteriorly and a patch of white tomentum at each extreme side just posterior to each tegula, the scutello-mesothoracic suture white-fasciate; basal grooves of second and third abdominal terga subfasciate, the first to the fourth with entire white apical fasciae, the sixth with a somewhat obscure patch of white tomentum; scopa white, brownish on sixth sternum.

*Type.*—Female; San Ignacio, Lower California, April, (Haines), [Calif. Acad. Sci.].

*Range.*—Southern California, Arizona and Texas, April and May. Definite records are as follows:

ARIZONA: 1♀, Florence, May 18, 1903. 1♀, Wellton, Yuma County, May 5 and 6, 1918, (Bradley).

CALIFORNIA: 1♀, Box Canyon, Apr. 13, 1934. 1♀, Guachella Valley, near Oasis, Apr. 19, 1925; (both Timberlake, on *Cercidium Torreyanum*). 6♀, Palm Springs, May 11, 1935, (Michener, on *Cercidium Torreyanum*).

MEXICO: 1♀, San Ignacio, Lower California, Apr., 1889, (Haines).

TEXAS: 1♀, Bexar County, Apr. 28, 1933, (Parks).

*Flower records.*—*Cercidium Torreyanum.*

**Megachile (Chelostomoides) manni** Mitchell (Pl. XXIX.)

*Megachile (Chelostomoides) manni* Mitchell, Trans. Am. Ent. Soc., LIX, p. 355, 1934.

The female of this species was fully described in Part I of this Revision, and the male also, except for the abdominal sternites and genital armature, descriptions of which follow:

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite considerably longer than broad, median portion almost linear, the medasternite bare medially, but with quite long fine setae laterally, its apical margin broadly and very deeply incurved, the apical margin strongly outcurved on each side, extending over the lateral portions of the presternite, the poststernal strip largely covered by the medasternite, narrow medially, broadened laterally; lateral portions of sixth presternite about as broad as long, entirely bare, the medasternal areas definite, well separated, subtriangular, closely set with robust, straight, flattened and pointed setae, the poststernal lobe extensive, very broad basally, somewhat narrowed and truncate apically.

Genital armature: Stipites slender, compressed toward the apex, the tips rounded, slightly dilated and rather abruptly flexed; sagittae slender, compressed, slightly bowed, the tips very slightly dilated; volsellae robust, the tips obliquely truncate.

*Type.*—Female; Ramsey Canyon, Huachuca Mts., Arizona, (W. M. Mann), [U.S.N.M., no. 40567].

*Allotype.*—Male; topotypical.

*Range.*—No specimens other than the type series have come to hand, and therefore the range cannot be extended beyond the type locality yet.

**Megachile (Chelostomoides) odontostoma** Cockerell (Pl. XXVII.)

*Megachile odontostoma* Cockerell, Proc. Calif. Acad. Sci., (4), xxvii, p. 550, 1924.

*Female.*—Size: Length 9-10 mm.; breadth of abdomen 2.5 mm.; anterior wing 6 mm.

Structure: Face slightly broader than long; eyes very slightly divergent below; clypeus much modified, with a small median tubercle, the apical margin on each side produced into an acute triangular projection; mandible long and narrow, 3-dentate apically, and with a blunt subbasal inner tooth; basal joint of flagellum slightly shorter than the second joint, the two combined about equalling the pedicel, middle joints but slightly longer than wide; lateral ocelli slightly nearer eyes than to each other or to edge of vertex; vertex slightly convex, hind margin almost straight; metatarsi shorter and narrower than their tibiae; basal grooves of abdominal terga rather shallow, the terga but slightly depressed apically; apical lip of sixth tergum not abrupt.

Puncturation: Fine for the most part, close on head and thorax, extremely so on cheeks; very close and fine on basal abdominal segment, relatively coarse and sparse on the second to fourth, closer on the fifth and sixth.

Color: Black; antennae and tegulae ferruginous; legs reddish; spurs yellow; wings hyaline, the nervures ferruginous.

Pubescence: Entirely white and rather thin on head, thorax and basal abdominal segment, the apical terga with short inconspicuous dark hairs, the median terga very thinly pubescent; mesonotum with two short oblique anterior lines of white tomentum, the scutello-mesothoracic suture white-fasciate, and first to fourth terga with entire white apical fasciae, the basal grooves not fasciate; scopa white, with but a few brownish hairs at the tip of the sixth sternum.

*Type.*—Female; Puerto Ballandra, Garman Island, Gulf of California, May 22, 1921, (E. P. Van Duzee), [Calif. Ac. Sci., no. 1515].

*Range.*—Arizona and Southern California, south into Mexico. Specimens at hand bear the following data:

ARIZONA: 1♀, Florence, May 23, 1903.

CALIFORNIA: 3♀, five miles north of Indio, Apr. 10, (Michener, on *Prosopis juliflora*). 3♂, 3♀, five miles south of Oasis, Riverside County, Mar. 29, 1936, (E. G. Linsley, on *Prosopis sp.*). 1♀, Palm Springs, Andreas Canyon, May 15, 1932, (Timberlake, on *Acacia greggii*). 1♀, San Diego County, (Coquillett).

*Flower records.—Acacia greggii, Prosopis juliflora.*

**Megachile (Chelostomoides) duplexa** Mitchell (Pl. XXVIII.)

*Megachile (Chelostomoides) duplexa* Mitchell, Trans. Am. Ent. Soc., LIX, p. 353, 1934.

The capture of a *duplexa* ♂ and *odontostoma* ♀ at the same locality and date suggest the probability that the two are the same.

This was described except for the male sternites and genital armature in Part I of this Revision. Descriptions of these structures follow:

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite rather broad and short, median portion linear, the medasternite largely membraneous, with quite slender setae which are abruptly and very broadly dilated and flexed apically, the poststernal strip straight; lateral portions of sixth presternite somewhat longer than broad, the medasternal areas quite extensive, slightly separated, closely beset with straight slender setae which are abruptly flexed and widely dilated apically, the poststernal lobe broad basally, somewhat narrowed to the broadly rounded apical margin.

Genital armature: Stipites quite robust, slightly flexed toward the compressed tips, with numerous plumose hairs along the dorsal surface; sagittae considerably shorter and more slender than stipites, relatively straight; volsellae quite robust, subacute apically.

*Type.*—Male; Alamogordo, New Mexico, April 19, 1902, [A.N.S.P., no. 4164].

*Range.*—California and New Mexico. Two additional specimens, from California, have come to hand since this species was described. These bear the following data: 1 ♂, Palm Springs, April 3, 1925, (Timberlake, on mesquite). 1 ♂, five miles north of Indio, Apr. 10, (Michener, on *Prosopis juliflora*).

*Flower records.*—*Prosopis juliflora.*

**Megachile (Chelostomoides) browni** Mitchell (Pl. XXVIII.)

*Megachile (Chelostomoides) browni* Mitchell, Trans. Am. Ent. Soc., LIX, p. 354, 1934.

This species was described, except for the male sternites and genital armature, in Part I of this Revision. Descriptions of these structures follow:

Sternite: Fourth sternum hidden but unmodified; lateral portions of fifth presternite quite broad, median portion short linear, the medasternite largely membraneous, broad, with about four transverse rows of setae which are directed basally and are long and extremely widely dilated and flattened apically, those toward the apical margin at each side shorter and closer, the poststernal strip nearly straight; lateral portions of sixth presternite small, the medasternal areas extensive, widely separated, uniformly covered with rather robust setae, most of which are flexed and abruptly dilated and flattened at tip, a few plumose setae laterad of these apparently belonging to the presternite, the poststernal lobe broad basally, narrowed apically, the tip slightly emarginate.

Genital armature: Stipites quite robust, slightly dilated, flattened, and flexed apically with rounded tips, a few short, plumose hairs along the inner surface medially; sagittae shorter and less robust, somewhat enlarged toward the base; volsellae quite robust, acute apically.

*Type.*—Male; Yuma, Arizona, June 1905, (Hbt. Brown), [U.S.N.M., no. 40568].

*Range.*—Arizona. No material other than the type series of two specimens has come to hand.

**Megachile (Chelostomoides) rugifrons** Smith

(Pls. XXVI, XXVII, XXIX.)

*Chelostoma rugifrons* Smith, Cat. Hym. Brit. Mus., II, p. 220, 1854. Cresson, Proc. Ent. Soc. Phila., II, p. 382, 1864. Schletterer, Zool. Jahrb, Syst., IV, p. 649, 1889.

*Megachile rufimanus* Robertson, Trans. Am. Ent. Soc., XVIII, p. 65, 1891. Friese, Das Tierr., Lfg. 28, Apidae I, p. 245, 1911.

*Eriades rugifrons* Dalla Torre, Cat. Hym., X, p. 379, 1896.

*Chelostomoides rufimanus* Robertson, Can. Ent., XXXIII, p. 231, 1901. Robertson, Trans. Am. Ent. Soc., XXIX, p. 171, 1903.

*Chelostomoides rugifrons* Cockerell, Can. Ent., XXXVI, p. 301, 1904.

*Female.*—Size: Length 13-15 mm.; breadth of abdomen 4 mm.; anterior wing 9-9.5 mm.

Structure: Face broader than long; eyes small, slightly divergent below; clypeus much modified, the upper face practically obliterated medially, composed laterally of narrow oblique carina-like faces, lower face extensive, flattened and shining; mandible long and narrow, inconspicuously 3-dentate apically, and with a denticulate angle near the base; vertex long, rounded, its surface forming but a very slight angle with the surface of the face in profile; cheeks broader than eyes; lateral ocelli much nearer eyes than to edge of vertex, and much nearer each other than to eyes; basal joint of flagellum about half the length of the pedicel, the second joint hardly equaling the pedicel; metatarsi shorter and narrower than their tibiae; second to fourth abdominal terga with deep basal grooves, the apical margins only slightly depressed laterally.

Puncturation: Coarse and deep in general, close but not contiguous on vertex, cheeks, mesonotum and scutellum; contiguous on pleura; somewhat finer and more widely separated over most of abdomen, but close on the basal and apical terga, and on the median ones laterally and across apical margins; very fine and close on face below ocelli.

Color: Black, including antennae and legs; tegulae more piceous; wings uniformly moderately infuscated, the nervures piceous to black; spurs yellowish-ferruginous.

Pubescence: Short and white across lower part of face, on cheeks below, on pleura, propodeum, legs, and on basal abdominal segment laterally, with a patch of white tomentum on the sixth tergum basally; black and very short on vertex, mesonotum, scutellum, and abdominal terga, longer on scutellum, extremely short on abdomen except on the fifth tergum; second to fourth terga with white apical fasciae, slightly interrupted on the second; scopa white, blackish on sixth sternum.

*Male.*—Size: Length 9–10 mm.; breadth of abdomen 2.5 mm.; anterior wing 6.5 mm.

Structure: Clypeal margin very slightly emarginate medially, otherwise entire; mandible 3–dentate, without an inferior projection; lateral ocelli nearer eyes than to edge of vertex; coxal spines lacking; front tarsi slender and simple; basal grooves definite on the median abdominal terga, the apical margins of these quite deeply depressed; carina of sixth tergum barely evident, very slightly emarginate medially.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite considerably longer than broad, almost linear medially, the medasternite largely membraneous, clothed over the apical half with robust setae which are abruptly flexed and broadly dilated apically, these toward the sides very long, directed basally, the poststernal strip nearly straight; lateral portions of sixth presternite triangularly pointed apically where there is a patch of long plumose hairs, the medasternal areas extensive, not separated, closely set with apically flexed and slightly dilated setae, those toward the sides considerably longer and more dilated than those near the center, the poststernal lobe extensive, not quite half as broad as the total width of the sternum, broadly rounded apically.

Genital armature: Stipites much narrowed above base, gradually dilated to the robust, laterally flexed tips, bearing numerous short hairs toward the tip, those toward the base longer; sagittae more slender and shorter than stipites, tips slightly dilated, dorsally protuberant toward the base where they are much more widely separated than at tips; volsellae robust, broadly and obliquely truncate.

Puncturation: Coarse, close and deep on head; slightly less coarse, but close and deep on thorax; considerably finer on abdomen, close on the basal and apical terga, but relatively sparse on the median terga.

Color: Black; antennae ferruginous beneath, deeper red above; tegulae bronzy-ferruginous; front femora and tibiae brownish-yellow anteriorly, piceous or blackish posteriorly, middle and hind legs blackish, suffused with red; spurs yellow; wings subhyaline.

Pubescence: White in general, rather long and dense on face, clypeus and cheeks below; some very short barely evident dark pubescence intermixed with long white hairs on vertex and mesonotum, and some slight indications of black pubescence on the median abdominal segments; second to sixth terga with entire white basal fasciae, with no evidence of apical fasciae except at extreme sides of the basal tergum.

*Type.*—Female; Georgia, [Brit. Mus.].

*Range.*—North Carolina to Florida, west to Oklahoma and Nebraska, June, July and August. Definite records are as follows:

FLORIDA: 1♀, Royal Palm Park, Apr. 12-18, 1923.

GEORGIA: 1♂, Tifton, May 22, 1896.

MICHIGAN: 1♂, Midland County, June, 1934, (R. P. Dreisbach).

NEBRASKA: 2♂, War Bonnet Canyon, July 23, 1901, (on *Verbena*). Identified also from Dawes County and Weeping Water.

NORTH CAROLINA: 1♂, Carolina Beach, June 22, 1929, (on *Hypericum*). 1♀, Harnett County, June 5, 1931, (on *Tephrosia*). 3♀, Southport, June 23 & 24, 1928, (on *Hypericum*). 1♂, White Lake, May 20, 1934.

Specimens of *rugifrons* have been identified also from the following localities: Arkansas — Marion County; Illinois; and Kansas — Baldwin, Barber County and Riley County.

**Megachile (Chelostomoides) spinotulata** Mitchell (Pl. XXIX.)

*Megachine (Chelostomoides) spinotulata* Mitchell, Trans. Am. Ent. Soc., LIX, p. 357, 1934.

The external features of this species are given in detail in Part I and will not be repeated here. The male genitalia and hidden sternal plates are described below.

Sternites: Fourth sternum hidden but unmodified; lateral portions of fifth presternite very narrow, median portion long linear and straight, the medasternite extensive, very broad, entirely devoid of setae, much shortened medially by the broadly and deeply incurved apical margin, the poststernal strip deeply incised medially; lateral portions of sixth presternite rather broad, slightly produced apically, the medasternal areas peculiar, composed of a pair of short longitudinal and parallel lines of short setae located medially, and on each side a transverse double line of short setae, each ending in a quite prominent narrow lateral lobe, the posternal lobe greatly expanded, finely pubescent, its apical margin with a broad median incurved area which is delimited by two quite prominent angles.

Genital armature: Stipites much narrowed and strongly compressed above base, compressed to the tips which are slightly flexed laterally and bear a few hairs on the inner surface; sagittae shorter than stipites but more robust, strongly bowed, the tips being approximate and opposed; volsellae robust, the outer apical angle of each produced into a slender elongate projection, the inner apical angle evident but not acute.

*Type.*—Male; Los Angeles County, California, (Coquillett), [U.S.N.M., no. 39981].

*Allotype.*—Female; Topotypical, [U.S.N.M.].

*Range.*—California, Arizona and New Mexico. Definite records are as follows:

CALIFORNIA: 1 ♂, 1 ♀, Idyllwild, San Jacinto Mts., July 22, 1933, (Timberlake, on *Lotus argophyllus*). 1 ♂, Idyllwild, June 26, 1936, (M. Cazier). 1 ♀, Long Pine Canyon, San Antonio Mts., July 2, 1934, (Timberlake, on *Cordylanthus nevinii*). 1 ♀, Mountain Home Creek, San Bernardino Mts., Aug. 14, 1934, (Timberlake, on *Phacelia ramosissima*). 1 ♂, Mill Creek, San Bernardino County, Aug. 31, 1930; 1 ♂, Waterman Canyon, San Bernardino Mts., July 16, 1934, (on *Eriogonum fasciculatum*); 1 ♀, Cushinbury Sp., San Bernardino County, Aug. 19, 1932. 1 ♀, Altadena, July 31, 1934, (on *Cordylanthus rigidus*); 4 ♀, Hemit Valley, San Jacinto Mts., Aug. 15, 1934, (on *Lotus* sp.); (all Michener). 4 ♂, 14 ♀, Pine Valley, San Diego Co., Aug. 1 ♂, San Antonio Canyon, north of Ontario, 5300 ft., June 20, 1931, (Scullen). Identified also from Jacumba.

NEW MEXICO: 1 ♂, Alamogordo, May 12, 1902. 1 ♂, Highrolls, June 10, 1902.

Specimens of *spinotulata* have been identified also from Sabina Basin, Santa Catalina Mts., Arizona, July 8-20, 1916.

*Flower records.*—*Cordylanthus nevinii, C. rigidus, Lotus argophyllus, Phacelia ramosissima, Eriogonum fasciculatum.*

**Megachile (Chelostomoides) subspinotulata** Mitchell

*Megachile (Chelostomoides) subspinotulata* Mitchell, Trans. Am. Ent. Soc., LIX, p. 360, 1934.

This was described in Part I of this Revision. No additional specimens other than the type have been seen, and it is quite possible that it represents an individual variation of *spinotulata*.

*Type.*—Female; Coyote Mountains, Arizona, about 3500 ft., Aug. 4-7, 1916, [Am. Mus. Nat. Hist.].

**Megachile (Chelostomoides) ignacensis** Mitchell

*Megachile (Chelostomoides) ignacensis* Mitchell, Trans. Am. Ent. Soc., LIX, p. 352, 1934.

This was described in Part I of this Revision. No additional material has as yet come to hand, and there are consequently no records of its occurrence north of the Mexican border.

*Type.*—Female; San Ignacio, Lower California, April, 1909, (Haines), [A.N.S.P., no. 4163].

## ADDENDA

In Part I[8] of this revision (p. 304) reference is made to a few specimens of the Palaearctic Subgenus *Eutricharaea* which have been found in collections of Nearctic bees. At the time of publication of Part I no recently collected specimens of this group had been found, and consequently its present occurrence in North America was doubted.

More recently, however, Professor Timberlake has submitted a specimen of *Eutricharaea apicalis* collected at Rosemont, Va., in 1931, thus proving the present existence of that species on this continent. It becomes desirable, therefore, to include *Eutricharaea* in this revision, even though it is represented by an introduced and apparently not overly successful species.

### Subgenus **EUTRICHARAEA** Thomson

*Eutricharaea* Thomson, Scand. Hym., II, p. 228, 1872.
*Paramegachile* Friese, Die Bienen Europa's, V, p. 34, 1899.[4]

First and second joints of labial palpus subequal in length; maxillary palpi minutely pubescent, the third joint longer and more slender than the second.

*Female.*—Mandibles 4-dentate, a cutting edge between the third and fourth teeth, this almost or entirely lacking between the second and third teeth; basal joint of flagellum subequal to pedicel; mid and hind metatarsi distinctly shorter and slightly narrower than their tibiae; claws with minute basal teeth; abdomen cordate, the sixth tergum usually straight in profile, the sterna with white apical fasciae evident beneath the scopa, the sixth sternum without a bare apical lip.

*Male.*—Mandibles 3-dentate, with a basal inferior projection; basal joint of flagellum subequal to pedicel, the second joint much longer; cheeks simple and unmodified below, where the pubescence is usually longer and more dense; front coxae with rather short though definite spines which are somewhat obscured by the pubescence, with no red bristles in evidence;

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[8] Trans. Am. Ent. Soc., LIX, 295-361, 1934.

[4] Bibliography incomplete.

front tarsi slender and simple; mid tibia with the usual apical spur; claws with at most but microscopic basal teeth; sixth tergum with a low transverse carina which is usually denticulate or serrate, with an indistinct median emargination, the apical margin of the segment lacking distinct teeth; fifth and sixth terga often densely pale tomentose; fourth sternum exposed.

**Megachile (Eutricharaea) apicalis** Spinola

*Megachile apicalis* Spinola, Insect. Ligur., II, p. 259, N. 94, 1908.[5]
*Megachile virginiana* Mitchell, Trans. Am. Ent. Soc., LII, p. 113, 1926.

The female of *apicalis* is easily recognizable by the peculiar angulate apical margin of the clypeus, the margin being rather broadly emarginate on each side of this conspicuous median angle. This character, together with the apical white fasciae on the abdominal sterna, beneath the scopa, will serve to distinguish it from any other known Nearctic species.

The males of *Eutricharaea*, however, are more difficult to separate, and it is not possible to say positively that the two male specimens of this group which are recorded below are *apicalis*. In fact, at the time they were orginally examined they appeared to more nearly agree with another closely related species, *rotundata*, but neither one of these specimens is now at hand for verification of this detail. The fact that the record on one of these is quite similar to the record on a female of *apicalis* indicates the possibility that the two were collected in the same locality and represent the same species. Moreover, it would seem justified to assume that any male of this subgenus occurring in the same general locality as female *apicalis* is the male of that species, unless females or recognized males of other species were discovered.

The males of most species of *Eutricharaea* may be recognized by the absence of distinct teeth on the apical margin (not the carina) of the sixth tergum, being otherwise quite similar to *Litomegachile*. In both *apicalis* and *rotundata* the sixth tergum is densely white tomentose and the fifth is tomentose basally, black pubescent and non-fasciate apically.

A more complete description of the female follows:

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[5] Biography incomplete.

*Female.*—Size: Length 10 mm.; breadth of abdomen 3 mm.; anterior wing 6.5 mm.

Structure: Face longer than broad; eyes slightly convergent below; clypeal margin emarginate on each side of a median conspicuous angle; mandible with three distinct apical teeth, an obscure angle between the third tooth and the inner angle, where a cutting edge is located; basal joints of flagellum subequal in length to the pedicel; lateral ocelli slightly nearer eyes than to edge of vertex; margin of vertex straight; cheeks narrower than eyes; apical margins of abdominal terga depressed toward sides only, the fourth slightly so medially. the sixth tergum straight in profile, with abundant suberect hairs visible; the sixth sternum sparsely covered with scopal hairs.

Puncturation: Dense and rather coarse on upper portion of face, vertex and over most of thorax; coarse and close on clypeus except for a median shining impunctate line and the angulate portion of the apical margin; sparse laterally on discs of abdominal terga, but fine and close on the more basal segments, minute and crowded on the sixth tergum.

Color: Black; antennae beneath reddish-piceous; tegulae yellowish anteriorly, otherwise more piceous; spurs yellowish; wings lightly infuscated, slightly darker apically, the nervures reddish-piceous.

Pubescence: White on head, thorax and basal segment of abdomen, dense around bases of antennae and along inner orbits, on pleura and propodeum and on basal segment of abdomen laterally; very thin on vertex and dorsum of thorax, with inconspicuous shorter darker hairs; discs of abdominal terga with short thin erect blackish pubescence which is very inconspicuous medially, that on the sixth entirely covering the plate, but longer laterally; first to fifth terga with white apical fasciae, very thin medially on all except the fifth, very broad and dense laterally; second to fifth sterna with thin entire white apical fasciae; scopa white on second and third sterna and in part on the fourth, black on the fifth and sixth and across the apical margin of the fourth.

*Records.*—1 ♀, Virginia, (described as *M. virginiana*), [A.N. S.P., No. 10548]. 1 ♀, Canada. 1 ♀, no locality record, " pupa found in ground, July 6, 83 ". 1 ♂, (?) no locality record, " found about six inches under ground in July 12, 83 ". 1 ♂, (?), New Jersey. [all A.N.S.P.]. 1 ♀, Rosemont, Va., June 12, 1931, (Timberlake, on *Centaurea cyanus*).

Since the publication of Part V [2] of this revision, an apparently undescribed form of *Xeromegachile* has been discovered, a description of which follows:

**Megachile (Xeromegachile) laguniana** new species

*Female.*—Size: Length 13 mm.; breadth of abdomen 4.5 mm.; anterior wing 9 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin straight and entire; mandible 4-dentate; basal joint of flagellum slightly longer than pedicel, the second joint subequal to the pedicel; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat, its hind margin slightly incurved; cheeks slightly broader than eyes; all the metatarsi shorter and narrower than their respective tibiae; abdominal terga grooved basally, more so on the more basal segments, the fifth only very slightly so, the apical margins of these terga only slightly depressed toward sides, sixth tergum very nearly straight at sides in dorsal aspect and also in profile, with abundant erect hairs visible.

Puncturation: Close and fine on vertex medially, more coarse and distinct laterally; minute and crowded on supraclypeal area and clypeus above, becoming quite coarse and distinct below; close on pleura, quite fine above, coarser below; quite coarse on mesonotum, sparse in center where the surface is tesselate; fine and close over most of scutellum; very minute and close on basal segments of abdomen, becoming slightly more coarse and rather sparse on the fifth tergum, fine and quite close over the sixth.

Color: Black; antennae piceous; tegulae piceous with ferruginous blotches; wings lightly infuscated, the nervures piceous; spurs pale ferruginous to yellowish.

Pubescence: White on face, cheeks, pleura, scutellum, propodeum, legs and basal segment of abdomen; fuscous to blackish on vertex, disc of mesonotum and discs of second to fifth abdominal terga, but these with conspicuous dense white apical fasciae, that on the second thin medially, the sixth with erect black hairs and appressed silvery tomentum; scopa white, black on the sixth sternum and across the apical margin of the fifth.

*Type.*—Female; Laguna, San Diego County, Calif., June 23, 1926, (W. S. Wright, no. 365) [San Diego Nat. Hist. Mus.].

*Paratypes.*—6 females, topotypical, June 12-25, 1926 (W. S. Wright).

The paratype specimens are somewhat variable in two respects, viz. the relative coarseness of the punctures on the vertex laterally, and the amount of black in the scopa posteriorly. Regarding the first of these, in two of the specimens the punctures on the vertex laterally are but very slightly more coarse and sparse, compared to the median portion of this area. With respect to the scopa, the color is entirely black on the sixth sternum on all but one specimen, in which the hairs basally are pale. In all, however, there are at least a few lateral black hairs in the scopa across the apical margin of the fifth sternum.

In the key to species of *Xeromegachile*[6] this runs rather definitely to *mojavensis*, but appears to be distinct from it. In *mojavensis* the clypeus is more convex (being quite flat in *laguniana*), with the punctures much more uniform in size and density basally and apically. The punctures of the vertex, mesonotum and scutellum are more fine and distinct, and the surface between punctures is shining, rather than tessellate. There is no dark pubescence on the second tergum, while the sixth has considerably less pale tomentum.

To complete this revision it is now only necessary to refer to four names that have been applied to species of *Megachile*, but for one reason or another have not been included in any of the subgeneric groups of species that have been established.

**Megachile vandykei** Cockerell (=*Delomegachile gemula* var. *cressonii* D. T.)

*Megachile vandykei* Cockerell, Proc. Calif. Acad. Sci., xiv, p. 205, 1925.

The description of *vandykei* fits the melanistic form, *cressonii*, of *M.* (*Delomegachile*) *gemula* perfectly, and a recent comparison by Mr. C. D. Michener of the type of *vandykei* with a specimen of *cressonii* indicates that the two are the same.

**Megachile scaevus** Packard

**Megachile integer** Packard

*Megachile scaevus* and *Megachile integer* Packard, Psyche, vi, p. 341, 1892.

These two names were used by Packard in describing the nesting sites of two unidentifiable species of *Megachile*. He indicated Say as the author of both species, but no reference to these two names has been discovered in any of Say's papers nor in the literature anywhere. It seems probable, therefore, that they were manuscript names of Say's which he never published.

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[6] Trans. Am. Ent. Soc., LIX, 295-361, 1934.

**Megachile praedicta** Cockerell

*Megachile praedicta* Cockerell, Can. Ent., XL, p. 31, 1908.

This name was proposed for a fossil form, and as there has been no opportunity to examine it personally, no attempt has been made to place it in any of the recognized subgeneric groups of living species.

## EXPLANATION OF PLATES

### PLATE XXVI

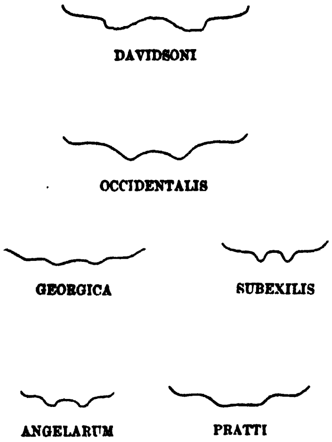
Outlines of front tarsus, clypeal margin and mandible in males of *Chelostomoides.*

### PLATE XXVII

Outlines of clypeus and mandible in females of *Chelostomoides.*

### PLATES XXXVIII and XXIX

Outlines of fifth, sixth and eighth sternum and genital armature in males of *Chelostomoides.*



DAVIDSONI

OCCIDENTALIS

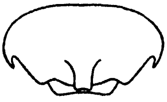
GEORGICA

SUBEXILIS

ANGELARUM

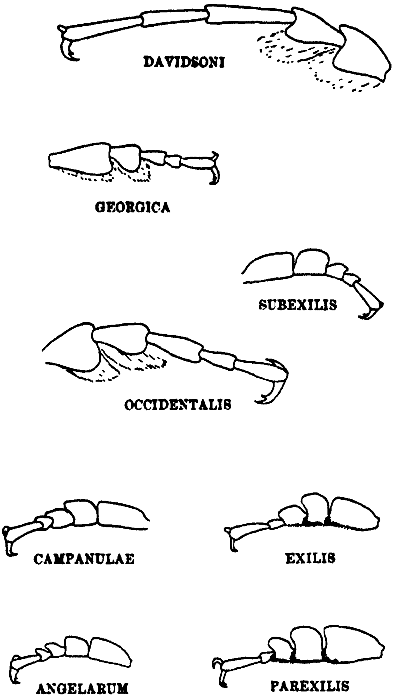
PRATTI

CLYPEAL MARGIN OF MALE



LOBATIFRONS

APEX OF MALE ABDOMEN



DAVIDSONI

GEORGICA

SUBEXILIS

OCCIDENTALIS

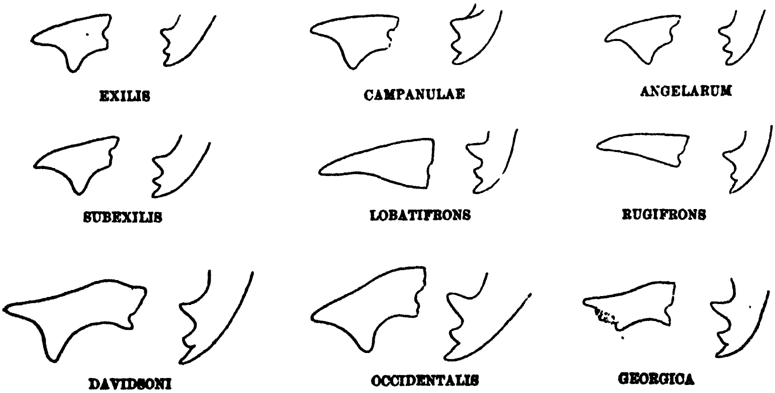
CAMPANULAE

EXILIS

ANGELARUM

PAREXILIS

MALE FRONT TARSUS



EXILIS

CAMPANULAE

ANGELARUM

SUBEXILIS

LOBATIFRONS

RUGIFRONS

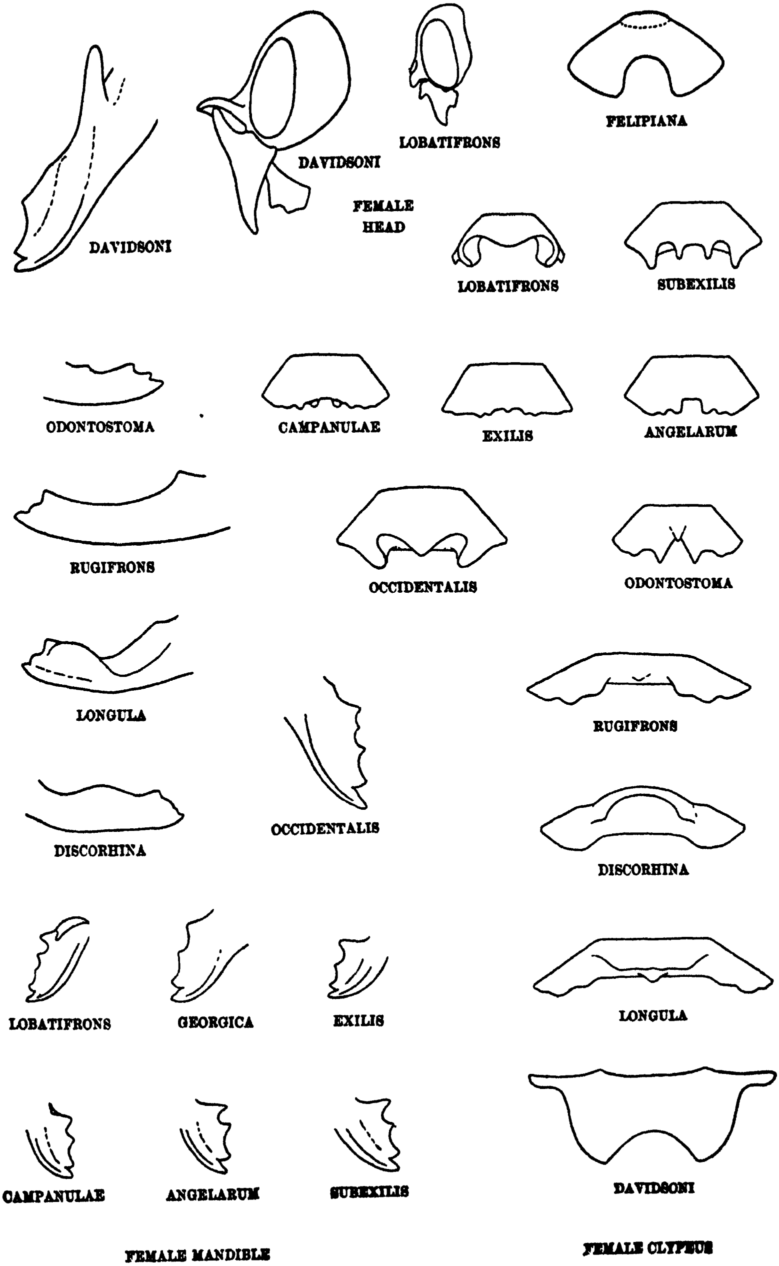
DAVIDSONI

OCCIDENTALIS

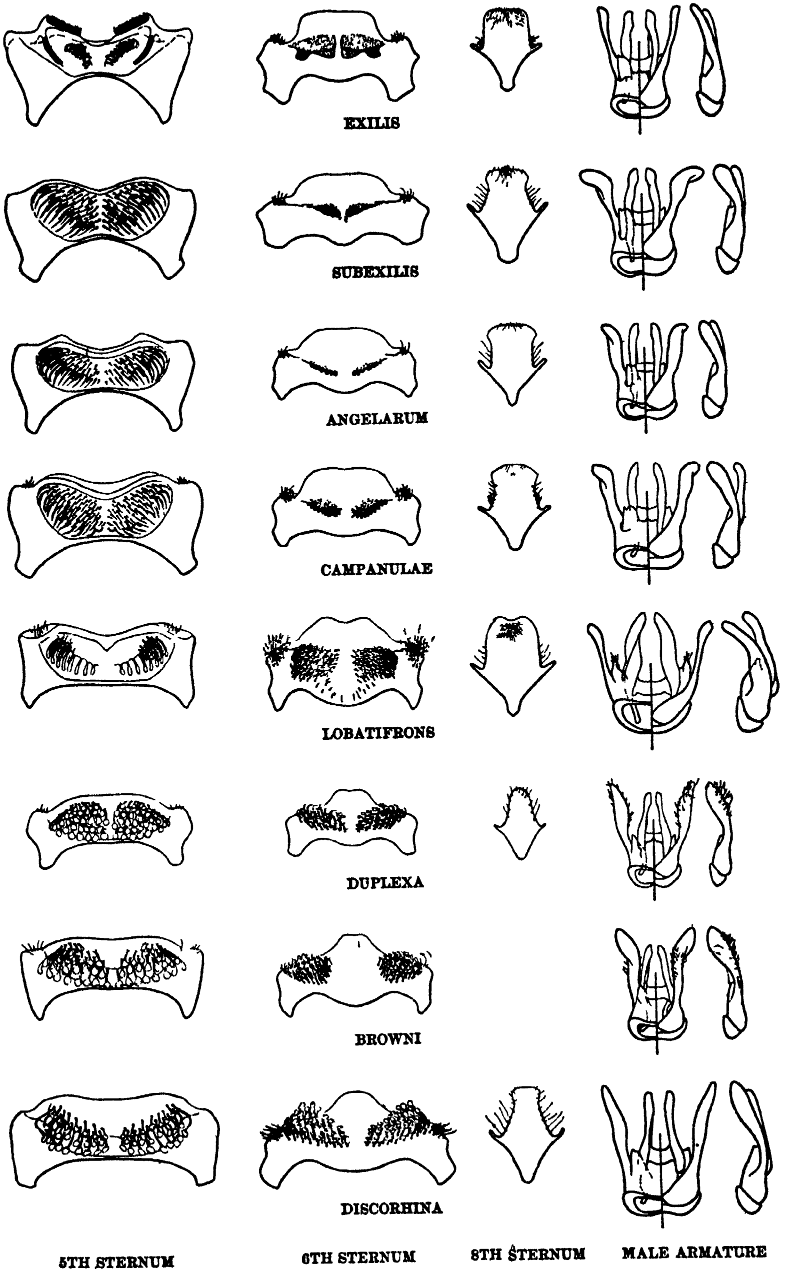
GEORGICA

MALE MANDIBLE

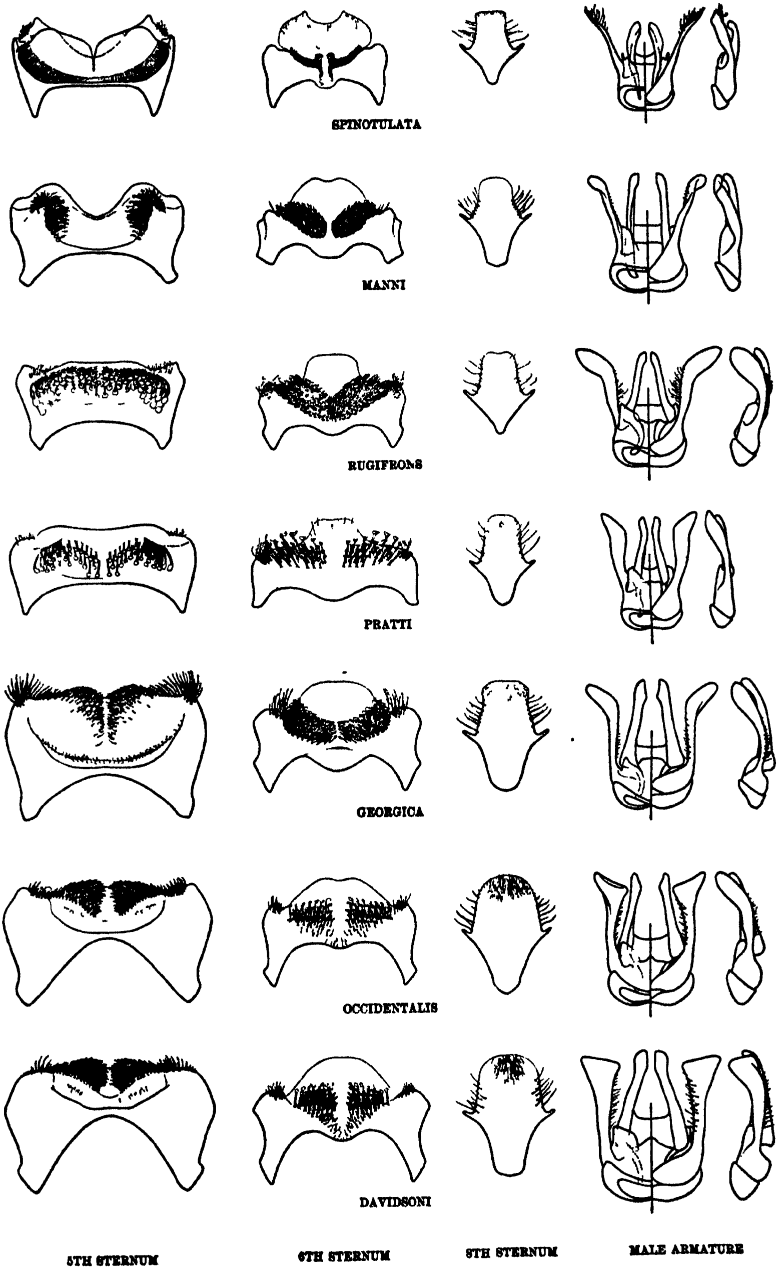
MITCHELL—NEARCTIC MEGACHILE



MITCHELL—NEARCTIC MEGACHILE



MITCHELL—NEARCTIC MEGACHILE



MITCHELL—NEARCTIC MEGACHILE

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# A NEW SPECIES OF TONKINACRIS FROM SZECHUAN

## (ORTHOPTERA: ACRIDIDAE)

By John W. H. Rehn

(Text figures)

In 1916 Carl[1] described the striking genus *Tonkinacris* for the new species *decoratus* from Tonkin. In his attempt to place the genus he compared it with both the Melanopli and the Coptacrae or Traulia. It is my belief from the examination of both the original species and the new one here described that the genus is an old world representative of the Melanoploid stock. However, it is not my intention, at this time, to ascertain its correct placement but in the near future I hope to be able to present a classification of the old world members of this extremely interesting group.

All of the material examined and recorded in this paper is in the Hebard Collection.

**Tonkinacris decoratus** Carl (Figs. 1, 4 and 6.)

1916. *Tonkinacris decoratus* Carl, Rev. Suisse Zool., xxiv, pp. 487, 488. [♂, ♀: Than-Moi; Tonkin, June-July, (Fruhstorfer leg.).]

We have before us at this time two males and one female with exactly the same data, which agree with his description. These specimens are undoubtedly from the same lot of material although they evidently were not examined by Dr. Carl when he published the description of this species.

*Specimens examined*: 3; 2♂, 1♀.

Tonkin, Than-Moi, June-July; (H. Fruhstorfer); two males, one female.

**Tonkinacris omei** new species (Figs. 2, 3 and 5.)

This form may be separated from *decoratus* the only other known species of the genus by its smaller size, relatively shorter tegmina and wings as well as by having a definitely carinate prozona which *decoratus* lacks. This new form has on the pronotum a narrow dark median stripe and relatively broad lateral bands that extend slightly mesad of the lateral angles instead of having a broad dark median stripe flanked by relatively narrow light bars and the dark bands on the lateral lobes extending far mesad of the lateral angles. In *omei* the tegmina are dark on most of the marginal field, a relatively narrow dark band behind the mediastine vein of the discoidal field and a narrow stripe along the edge of the anal field, while in *decoratus* the marginal field, a relatively larger area behind the mediastine vein and the largest portion of the anal area are dark, and the area between the marginal field and the dark area of the discoidal field is similarly suffused, the remainder of the tegmina being light.

---

[1] Rev. Suisse Zool., xxiv, p. 485, (1916).

In the males of *omei* the cerci are slender, their lower margin is more rounded and less appreciably angulate than in *decoratus*.

In the females of *omei* the upper ovipositor jaws have the apex relatively short and heavy, not more or less elongate and rather thin, the margin of the jaws are roughly crenulate instead of being serrulate; the cerci of this form are rather long, attenuated, while in *decoratus* they are short and thick.

*Type.*—♂; Mt. Omei, Baian - Kara - Ula Range, Szechuan, China. Elevation 3000-4000 ft. August 15, 1929. [Hebard Collection, Type no. 1323].

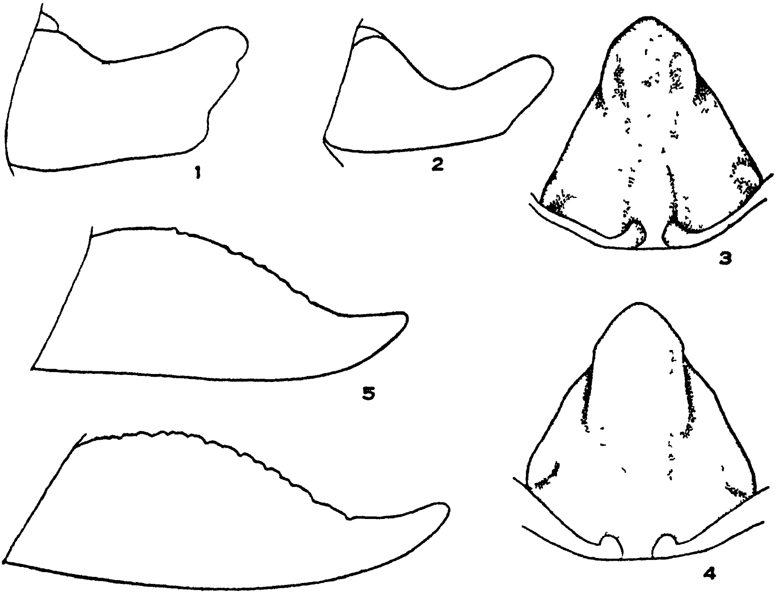
General size rather small, relatively slender, legs, particularly of male, heavy.

Head essentially as in *decoratus* but eyes slightly more globose and less elliptical; broader interocular space, which is equal to one-fourth the width of the eye.

Prothorax approximately twice as long as broad, with a median carina on both prozona and metazona, stronger on latter; episternal margin weakly concave, posterior margins oblique, posterior margin of disc roundly obtuse-angulate, remainder of pronotum, except for pattern, as in the genotype.

Tegmina lanceolate, one and one-half times as long as pronotum, apex rounded, extending to slightly more than proximal third of posterior femora, venation essentially as in *decoratus*.

Sub-genital plate relatively short, produced medianly into a relatively large, broadly rounded tubercle; super-anal plate sub-triangular with two longitudinal carina convergent to distal third, then slightly divergent, not quite attaining posterior margin, thickened and broadened in posterior two-thirds, apical third with convex meso-lateral carina which extend to margin of plate, anterio-lateral angles with a low tuberculate process: cerci elongate, with distal third directed meso-caudad; ventral margin relatively straight to distal third then passing by a rounded obtuse angulation into the weakly concave, more strongly so in proximal two-thirds; immediate apex narrowly rounded.



*Tonkinacris decoratus* Carl, ♂ (topotype) Than-Moi, Tonkin. Fig. 1.—Outline of cercus. Fig. 4.—Supra-anal plate. *T. decoratus,* ♀ (topotype). Fig. 6.—Outline of upper ovipositor valve.

*Tonkinacris omei* new species, ♂ (type), Mt. Omei, Szechuan, China. Fig. 2.—Outline of cercus. Fig. 3.—Supra-anal plate. *T. Omei* ♀ (allotype). Fig. 6.—Outline of upper ovipositor valve.

General color yellowish oil green, underside of body pale oil yellow. Face fuscous, eyes dark chocolate, a pair of relatively narrow black stripes passing from the post-orbital region and on the prothorax in large part ventrad of the lateral angles, a narrow black median stripe extending the entire length of the prothorax. Tegmina with most of the marginal field; a narrow area, which broadens toward the apex, behind the mediastine vein and the edge of the anal field are black while the remainder of the tegmina are yellowish courge green. Femora courge green on external surface, yellowish on internal except for a light yellowish preapical band on the posterior femora which also has the apex blackish, and two relatively broad, blackish bands one at the proximal and one at the distal third of the dorsal surface. Tibiae except posterior ones courge green, posterior ones glaucus. Tarsi olive to light fuscous.

*Allotype.* — ♀ ; same data as type except elevation 2500 ft., August 2, 1929.

The female of this species is essentially the same as the male except for the somewhat larger size, the slightly broader pronotum, and the apex of the abdomen.

Cerci conical, elongate, apex narrowly rounded. Upper ovipositor jaws relatively short and thick, apex short, rounded acute-angulate, not prolonged; dorsal margin slightly angulate near apex, proximad of this angulation the margin is crenulate. Lower ovipositor jaws and subgenital plate as in the female of *decoratus*.

Color essentially as in the male.

*Paratypic series.*—In the series before us there is no appreciable variation in any of the morphological structures or in the actual pattern, although in numerous individuals there is either an intensification or recession in the contrast of the color, the extremes with the light portions of the pattern varying from calliste green to relatively dark fuscous, however, the black portions of the pattern appear quite constant.

There is no appreciable size variation as can be seen from the following measurements.

| | Length of body | Length of prothorax | Length of tegmin | Length of posterior femora |
|---|---|---|---|---|
| Type ♂ ........ | 27.5 | 6.5 | 9.8 | 14. |
| Extremes ♂ .... | 25.8 — 29.5 | 6.2 — 6.8 | 9.5 — 10. | 13.3 — 14.4 |
| Allotype ♀ ..... | 33. | 8. | 11.1 | 16.9 |
| Extremes ♀ .... | 31.5 — 37.5 | 7.6 — 8. | 10.2 — 11.4 | 16. — 16.9 |

*Paratypes.*—72: 22 ♂ , 50 ♀ . Mt. Omei, Baian - Kara - Ula Range, Szechuan, China. VII, 13, 1929, 2 ♀ ; VII, 19, 1929, 1 ♂ , 2 ♀ ; 4000 ft., VII, 24, 1929, 1 ♀ ; 3500 ft., VII, 26, 1929, 1 ♀ ; 2500 ft., VIII, 2, 1929, 3 ♂ , 2 ♀ ; 2500 ft., VIII, 6, 1929, 4 ♂ , 10 ♀ ; 2500 ft., VIII, 8, 1929, 2 ♂ , 2 ♀ ; 3000-4000 ft., VIII, 13, 1929, 1 ♂ , 9 ♀ ; 3000-4000 ft., VIII, 15, 1929, 5 ♂ , 9 ♀ ; 3500-4500 ft., VIII, 24, 1929, 5 ♂ , 12 ♀ ; no date or elevation, 1 ♀ .

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